PROCEEDINGS

OF THE

AMERICAN FORESTRY CONGRESS

AT ITS MEETING HELD IN BOSTON, SEPTEMBER, 1885.

WASHINGTON:
JUDD & DETWEILER, PRINTERS.
1886.

PROCEEDINGS

OF THE

AMERICAN FORESTRY CONGRESS

AT ITS MEETING HELD IN BOSTON, SEPTEMBER, 1885.

WASHINGTON:
JUDD & DETWEILER, PRINTERS.
1886.

NOTE.

This sketch of the recent meeting of the American Forestry Congress at Boston, is issued in anticipation of the publication of the full report of its proceedings, including the papers read, and others not read for want of time, together with a sketch of the proceedings at Saratoga in 1884. The present publication is issued for the purpose of informing the general public of the character and work of the Congress, and to invite their coöperation with it. The work appeals to every one who cares for the welfare of the country, and the Committee invite all to whom this preliminary sketch may be sent to become members of the Congress by transmitting to the Corresponding Secretary, Mr. B. E. Fernow, No. 13 Burling Slip, New York city, the membership fee or larger sums as a contribution to the publication fund. At the meeting in Boston several gentlemen made subscriptions of $20 each.

Ten dollars constitutes one a life member of the Congress. Other members pay $2 as an initiation fee, and $2 annually while they continue to be members. Any one sending $1 to the Corresponding Secretary will receive a copy of the complete report as soon as published.

N. H. Egleston,
F. W. Brewer,
B. E. Fernow,
Committee of Publication.

CONSTITUTION AND BY-LAWS

OF THE

AMERICAN FORESTRY CONGRESS.

ARTICLE 1. This Association shall be known as the American Forestry Congress.

ARTICLE II. The objects of this Congress shall be the discussion of subjects relating to tree planting; the conservation, management, and renewal of forests; the climatic and other influences that affect their welfare; the collection of forest statistics, and the advancement of educational, legislative, or other measures tending to the promotion of these objects. It shall specially endeavor to centralize the work done and diffuse the knowledge gained.

ARTICLE III. Any person may be elected a member of this Congress upon the recommendation of two members and the payment of two dollars. The annual dues shall be two dollar.

ARTICLE IV. The officers of this Congress, to be elected at the annual meeting, are as follows: President, first Vice-President, second Vice-President, Recording Secretary, Corresponding Secretary, Treasurer.

ARTICLE V. The President shall preside at all meetings of the Congress in General Session, and deliver an annual address at the close of his term.

ARTICLE VI. The President, Vice-Presidents, Secretaries, Treasurer, and five other persons to be chosen annually, shall constitute an Executive Committee for the transaction of such business as may be required by this Constitution or by a vote of the Congress.

ARTICLE VII. The Recording Secretary shall keep a record of the proceedings of the Congress, and shall be custodian of all documents, books, and collections ordered to be preserved.

ARTICLE VIII. The Corresponding Secretary shall conduct the correspondence of the Congress.

ARTICLE IX. The Treasurer shall have charge of all funds, and pay out the same on the direction of the Executive Committee.

ARTICLE X. The Congress at any regular meeting, or its Executive Committee, in the intervals between its meetings, may appoint

such local or special committees as may be deemed proper, and shall define their duties.

ARTICLE XI. The annual meeting of the Congress shall be in the month of August or September, at such times and places as shall be determined by a vote in general session.

ARTICLE XII. At each annual meeting there shall be an election of officers for the ensuing year, and they shall remain in office until others are chosen. In cases of vacancies occurring in the intervals between the annual meetings they may be filled by the Executive Committee until others are selected. In case of absence of an officer at a regular meeting his place may be deemed vacant.

ARTICLE XIII. The officers of States, Territories, provinces, or Local Forestry Associations, or their delegates, or the delegates of any government, may participate in the proceedings of the Congress as Honorary Members.

ARTICLE XIV. This Constitution may be amended by a two-thirds vote of the members present at any annual meeting.

BY-LAWS.

1. Papers or abstracts of papers to be read must be sent two weeks before any meeting, for classification, to the Corresponding Secretary.

2. The following classification of subjects is adopted for the reading of papers:

Section A. Forest Planting, Forest Management, Forestry Proper, Preservation of Forests.

Section B. Forest Economy, Technology, and Statistics.

Section C. Applied Science and Climatology, General Topics.

3. Contributors who are present shall have the preference in reading their papers.

4. Any member shall be entitled to the privilege of using any books or documents, not of record, at the discretion of the Recording Secretary.

OFFICERS.

President, Hon. WARREN HIGLEY, New York city.
First Vice-President, Hon. H. G. JOLY, Quebec.
Second Vice-President, Hon. J. STERLING MORTON, Nebraska City, Neb.
Recording Secretary, N. H. EGLESTON, Washington, D. C.
Corresponding Secretary, B. E. FERNOW, 13 Burling Slip, New York city.
Treasurer, JOHN S. HICKS, Roslyn, Long Island.

EXECUTIVE COMMITTEE.

This committee consists of the above regular officers, together with—
Hon. B. G. NORTHROP, Clinton, Conn.
Hon. WILLIAM LITTLE, Montreal, Canada.
Hon. J. B. GRINNELL, Grinnell, Iowa.
Hon. J. G. KNAPP, Limona, Florida.
R. H. WARDER, Esq., North Bend, Ohio.

STANDING COMMITTEES FOR 1885-'6.

On New England Forest Policy: Gen. CHAS. HAMLIN and JOHN E. HOBBS, of Maine; WM. S. LADD and GEO. B. WALKER, of New Hampshire; FRANCIS H. APPLETON and WM. C. STRONG, of Massachusetts; HENRY G. RUSSELL and CHAS. W. SMITH, of Rhode Island; T. S. GOLD and B. G. NORTHROP, of Connecticut; REDFIELD PROCTOR and HIRAM CUTTING, of Vermont.

On Legislation: Ex-Gov. J. STERLING MORTON, of Nebraska; N. H. EGLESTON, of Washington, D. C.; Hon. T. S. GOLD, of Connecticut; Hon. H. R. LOW, of New York; Hon. J. B. GRINNELL, of Iowa.

On Arbor Day: Hon. B. G. NORTHROP, of Connecticut; N. H. EGLESTON, of Washington; Hon. J. B. PEASLEE, of Ohio.

On Publication: N. H. EGLESTON, Washington; F. W. BREWER, Hingham, Mass.; B. E. FERNOW, New York city.

PROCEEDINGS OF THE FOURTH ANNUAL MEETING

OF THE

AMERICAN FORESTRY CONGRESS.

The fourth annual meeting of the American Forestry Congress was held at Boston, Mass., September 22, 23, and 24, 1885. The meeting was one of great interest, and very encouraging to the members. One of the local papers heralded the approaching assembly in the following words:

It is not long since America was a forest without any congress. For a little more than a hundred years it has had a congress, and now it has too little forest. People are rapidly increasing, and trees are decreasing more rapidly. It is by no means true that there is not room for trees to increase as fast as the people do. The hills and mountains make it sure that there always will be. But they will soon be bare of trees—have nothing to cover them from the burning sun but scrub. If the people do not plant trees, and the right kind of trees, to grow on them, there is a possible desert in the future, with neither men nor trees on it, where population is now most abundant. A few thinking men and women, scattered all over North America, including the United States and Canada, have come to a realizing sense of this serious state of facts, and elected themselves into a Congress to look after the health and prosperity of the trees, which they correctly regard as the indispensable friends of men and animals. This Congress of scientific people from every part of Canada and about every State in this Union will meet at the invitation of the Massachusetts Horticultural Society, and hold sessions in Horticultural Hall September 22, 23, and 24, which will be freely open to the public.

Massachusetts and our own dear overcrowded Boston will give this Congress the warmest possible welcome. It comes here because it is delighted to know that in 1882 the Legislature of this Commonwealth put on its statute book a wise and well-considered general forestry law, constituting the Board of Agriculture a board of forestry, and authorizing the people of every town to devote land suitable to the purpose to be cared for as a public forest by that board. Under that law it is quite possible for the people of Boston to have within half an hour's ride in a steam or horse car the use of a public domain of 4,000 acres, covered with every variety of trees and commanding broad views of both salt and fresh water. If the people lend their ears to what this Congress has to say the thing is done.

The sessions of the Congress were held in Horticultural Hall. No place could have been more pleasant or better adapted to the use of the Congress. The Horticultural Society, so long and favorably known among similar societies and to the whole country by its record, had generously placed its hall at the disposal of the Congress, and had also kindly assumed the office of a committee of arrangements for the occasion. Beautiful plants and small evergreen trees in boxes stood along the stairway leading to the assembly room, and seemed themselves to give a very appropriate welcome to the Congress of Forestry men. In the hall itself long tables were spread, which were covered with specimens of forest products, some in their natural state and others manufactured, showing the beauty of many of our woods and their adaptation to decorative purposes.

Although the meeting of the Congress was held in the extreme eastern part of the country, there was a very good attendance, not only of the members resident in the vicinity, but of others from a great distance. California and Nebraska were represented, as well as Canada and the nearer States. Several of the States sent delegations

to the Congress, and the General Government was represented in the person of Commissioner Coleman of the Department of Agriculture.

Earnestness and enthusiasm characterized the meeting throughout its sessions. A looker on must have felt that the members were full of interest in the subject which they had in hand, and which had convened them at this time. The three days of the meeting were fully occupied with the reading of papers and the discussion of them, and some valuable papers which had been prepared for the occasion for lack of time could only be read by their title.

Promptly at the designated time President Higley called the Congress to order and introduced His Honor Mayor O'Brien, who welcomed the Congress to Boston very cordially, and expressed his pleasure in meeting its members. He expressed the hope also that the assembling of the Congress in Boston would have the effect of creating in its citizens an enthusiasm in behalf of forestry which would lead them not only to secure all needful planting of trees along the highways, but the carrying out of the plan for the preservation of the Middlesex Fells, a project which our friend, Mr. Elizur Wright, has so much at heart. The Mayor alluded to the progress which had been made in Boston in the course of the last ten years in securing the ground for several public parks, which, he said, in a few years more would make the city one of the most beautiful in America. His Honor closed by repeating his welcome of the Congress to the city, and expressing the hope that the body might find time to visit some of the public institutions.

President Higley responded to the welcome of His Honor the Mayor, and at the same time acknowledged the obligations of the Congress to the Agricultural and Horticultural Societies of Boston and vicinity for the interest which they had manifested in the work of the Congress by providing Horticultural Hall as its place of meeting, and in various ways providing for its success. The President then made his annual address to the Congress as follows:

ADDRESS OF PRESIDENT HIGLEY.

The subject that brings us together on this occasion from various sections of the United States and Canada has within the past few years grown to be recognized by the leaders of public opinion in America and thinking men and women generally as one of the greatest importance to the public welfare. The discussions of topics relating to forestry and the timber supply, in farmers' clubs, lumbermen's conventions, horticultural and agricultural societies, associations of scientists, and more than all in the meetings of the American Forestry Congress, and in local forestry associations, have awakened a deep and widespread interest in the subject, that in some sections has found expression in important action, and throughout America has laid the foundation, I believe, through the conviction of public opinion, for the sure and onward progress of our cause. Its principles are bound to grow and strengthen until an American system of forestry, adapted to the conditions of the new world, shall be established and shall prevail in all the essentials of successful working, because necessity will compel it sooner or later. Of such vital importance to the people of the United States and Canada is the subject of cultivating and preserving the forests that it must soon command the serious attention of the National and State governments.

Something, to be sure, has been done by way of legislation; a small start has been made through the efforts of a few thoughtful and patriotic men. But before such practical results can be obtained as we desire, the importance of forest preservation and forestry administration must become apparent to the majority of the people. This can be done only through public discussion, wise agitation, educating. Facts of history and personal experience are abundant and convincing as to the effects of deforesting and again of reforesting large areas, upon the climate, the springs and streams, the fertility of soil, the various industries, and the general prosperity.

CHINA.

With such a system of timber culture as Prussia possesses—perhaps the best in the world—China would have escaped those horrible famines which have in the past attacked some of her most densely populated districts and caused the destruction of

millions of people, and imposed untold sufferings upon millions more, as well as the loss of a vast amount of treasure to the state. Only last month came the news from Canton of a great flood, the most serious in thirty years. "More than ten thousand persons lost their lives," says the report, "and a far greater number are left in a starving condition. Entire villages were engulfed, and the rice and silk crops were almost ruined." These destructive floods are largely due to the absence of forests which were long ago cut away from the mountain slopes and the headwaters of streams to give place to the food crop for the support of her dense population. The natural office of the forests in securing moisture and productiveness to the country around was supplied by an extensive system of irrigation and fertilization. Vegetables form the staple of food in China, and this explains how it is that 400,000,000 people can exist in a country only four or five times larger than France. We are told that Chinese horticulture embraces *eighty* different kinds of vegetables, of which *twenty-five*, at least, constitute valuable articles of food for man. The most important of these is rice, for the cultivation of which the Chinese spare no labor or expense. To aid in the cultivation of this cereal they have stripped whole provinces of their original forests, dug immense lakes, and even tunneled lofty mountains. For its sake they collect the waters of both stream and river and direct its course from the mountain's foot over the soil they wish to irrigate. Agriculture to the Chinaman is almost a religion. He repeats to himself the words of the Persian law:

"Be thou just to the plant, to the bull, and to the horse; nor be thou unmindful of the dog. The earth has a right to be sown: neglect it and it will curse thee; fertilize it and it will be grateful to thee. It says to him who tills it from the right to the left, and from the left to the right, may thy fields bring forth of all that is good to eat, and may thy countless villages abound with prosperity."

Ceres, who at Thebes and at Athens brought men together and made the laws, was considered but the reflecting mind of men who till the soil.

CENTRAL NEW YORK.

There is abundant evidence in America of the effects of cutting off the forests. In Central New York streams that thirty or forty years ago kept the ponds well filled for the saw-mill and grist-mill, and furnished a never-failing supply of running water for the farm, are now dry in summer, with the exception of here and there a stagnant pool; the dam is decayed and washed away, the mills gone, and the once picturesque scene is changed to that of desolation. Yet, with the warm rains of spring and the melting snows, the streams overflow their banks, the swift waters carry away fences, bridges, and embankments. Spring opens later. The young cattle were wont to be turned into the wood-sheltered pasture about the first of April; now they are kept shut up until the middle of May. Peach orchards that were sure to be loaded every year with luscious fruit have almost disappeared, and the crop is the exception rather than the rule. The extremes of heat and cold are greater, and droughts in summer and floods in springtime are more frequent and more destructive. Trace the stream from its source and the cause of these things is apparent. The old tamarack swamp that used to supply the boys and girls with aromatic gum, and in which the creek had its source, has all been cut away. The thickly wooded black-ash swamps, through which the stream ran in its course to the lake, have been cleared, and their marshy areas have given place to cultivated fields and pastures. The cutting away the forests from the headwaters and the banks of this stream accounts for the changes I have noted, and this picture, I doubt not, is a very familiar one in the New England and Middle States. It is not difficult for men who know the effects of cutting the timber from small areas around the headwaters of the smaller streams to understand why summer navigation in the Mississippi, the Missouri, and the Ohio has become difficult and at times impossible where it was easy and constant a few years ago; or why the Hudson and the Connecticut are much lower in summer and higher in spring than in former years. The partial deforesting of the Adirondack region has materially affected the flow of of the Hudson, the Mohawk, the Black, and other rivers, and sufficiently demonstrated the fact that were this great watershed of New York stripped of its forest covering, the Empire State would lose her prestige and New York city her rank as the first commercial city of the New World.

THE SCHUYLKILL.

For two years past the engineers of the water-works department of Philadelphia have been making examinations of all possible sources of a suitable water supply for their city, and have lately discovered how seriously the Schuylkill, from which the water supply is now taken, has been affected by the destruction of forests around its

headwaters. Sixty years ago the Schuylkill's summer flow was estimated at 500,000,000 gallons a day. Measurements made from time to time showed a gradual diminution, until in 1874 the minimum flow was only 250,000,000 gallons per day. This is a well authenticated fact, and it is shown that the diminution has been caused by cutting the forests from the headwaters of the supplying streams.

THE FRENCH ALPS.

In 1844 the eminent political economist, M. Blanqui, after visiting the provinces embracing the French Alps, once densely populated and prosperous in agriculture and grazing, presented to the academy a detailed memoir of his journey and observations, and, among other things, said:

"The Alps of Provence present a terrible aspect. In the more equable climate of northern France one can form no conception of those parched mountain gorges where not even a bush can be found to shelter a bird, where, at most, the wanderer sees in summer here and there a withered lavender, where all the springs were dried up, and where a dead silence, hardly broken by the hum of an insect, prevails. But if a storm bursts forth, masses of water suddenly shoot from the mountain heights into the shattered gulfs, waste without irrigating, deluge without refreshing the soil they overflow in their swift descent, and leave it even more scarred than it was from want of moisture. Man at last retires from the fearful desert, and I have the present season found not a living soul in districts where I remember to have enjoyed hospitality thirty years ago."

Such warnings of history are abundant. It is unnecessary to multiply them here. They are familiar to you from their frequent repetition. And yet it is time the people of America learn the sad history of suffering and desolation that have followed the destruction of the forests in the earlier-settled portions of the earth—in China and India, in Persia and Greece, in Switzerland, in portions of France and Italy, on the Istrian coasts of the Adriatic and the extensive shores of the Mediterranean, in Spain and in Palestine, whose rich fields, when her rugged hills and mountain sides were crowned with the sacred cedar, "flowed with milk and honey;" in classic Sicily, once the granary of Rome, and in many of the most beautiful islands of the sea—that they may heed the warning, study the forest conditions, and take the necessary steps to prevent the useless destruction now going on, and thereby escape the fate of those nations and communities that have in the past so recklessly made the unfortunate experiment of stripping the forests from valley and hill and mountain. From the history of these things, and the known data established by long-continued investigation and repeated experiment, we are justified in asserting:

1. That the forest areas exercise a positive climatic influence upon the surrounding country. They modify the extremes of heat and cold, and render the temperature more equable throughout the year.

2. That the deforesting of large areas of hilly and mountainous country affects to a very large extent the quantity of water that comes from springs and flows in rivers. The more apparent is this when the deforesting occurs on the headwaters of important streams. Then the water-power is destroyed or greatly impaired, navigation impeded, commerce interfered with, and droughts and floods are more frequent and more severe.

3. That the interests of agriculture and horticulture are greatly subserved by the proper distribution of forest areas through their climatic and hydrographic influence.

4. That a country, embracing within its borders the headwaters of all the streams and rivers that interlace it, when stripped of its forest covering, becomes a barren waste, incapable of supporting man or beast.

These general facts have been determined beyond question. But it remains for the people of every State and district to decide upon the necessary area and distribution of forest trees for each general locality, and the details incident to their planting, care, and preservation.

PROFITS IN FORESTRY.

The people naturally live and calculate for the present, and are disposed to use the property belonging to themselves so as to derive from it the greatest present good. For the good of neighbors, or the future welfare of the State, they will hardly be induced to forego the advantages to be derived from the cutting of timber and the drainage of swamps, though they knew that such cutting and drainage will eventually result in disaster to the country around; nor would it be fair and equitable for the individual to suffer in his estate for the advantage that might accrue to others, either in this or in future generations. The burden of sacrifice for the public good should be borne by all alike. But the true interests of forestry makes no such demand. On

the contrary, we claim that a wise management of the forest areas connected with the farmers' estates, and the maintenance of a due proportion of them through devoting to forestry purposes the now waste places of the farm, insure to the owner excellent returns for his labor and for the capital invested—a profit that compares favorably with that derived from the ploughed field. This becomes apparent when a fair money value is placed on all the wood and forest product used in many ways on the farm, as well as the timber that is cut for market. The timbered lot is not the dead property that it is often considered to be, and it is worthy the farmer's intelligent care and protection as a source of income.

Until this question is answered affirmatively and demonstrated satisfactorily, Americans will be slow to engage in tree planting for business purposes. Actuated by a sentiment for the beautiful, they will plant trees and adorn the landscape, and even preserve the forest, but not with a view to realize a profit thereby. Until settlements were pushed out into the treeless plains of the West, the necessity for forestry products on the farm had hardly been realized in this country, but then, through the want of them, their full value and countless blessings became apparent to the Kansas and Nebraska emigrant and the dwellers on the prairies of the West. They soon found it profitable to plant and care for trees. Twenty-five years ago cord-wood sold in some of the towns of Kansas and Nebraska for seven, eight, and sometimes ten dollars a cord, where it can now be purchased for from three to four dollars per cord, and that, too, with a population many times greater. "The reason for this," says ex-Governor Morton, "is simply from the fact that the natural groves have been protected from fire, and the artificial groves are turning out an abundance of good wood, such as the necessities of the country demand for fuel." The cultivation of forest trees in the prairie States has proved profitable, according to the testimony of those who have engaged in it. J. W. Davidson, in an article on "Timber Growing in Nebraska," says: "I estimate the cost of preparing an acre, and getting the cuttings of soft maple and ash (they can be had by the thousands along our streams), at $3 per acre. A man can plant 2½ acres per day. That is all the cost for ten years, except interest and taxes on land. I have 1,261 trees per acre. Seven years from planting I will cut one-fourth, or 340 trees, equal to 15 cords of wood; the eighth year 15 cords more; the ninth the same; the tenth year you see my profits. I should cut what is left, 456 trees. Allow four trees to the cord, so as not to overestimate it. I have several trees only ten years old which are 14 inches in diameter and 50 feet high. Four, I think, would make a cord. Allowing six trees to the cord, we have 76 cords, and with 45 cords cut before, 121 cords. At $3 per cord, allowing $1 for cutting, I have $242. As a source of profit, the raising of trees in Nebraska ranks next to the raising of stock."

Many experiments of forest culture have been made in New York and in the New England States with satisfactory results. The financial success of forest culture as a business must depend upon the cost of the land, the adaptability of the trees to the soil and climate, and the marketable value of the wood and timber when grown. While it may be profitable to grow forests in those sections of the country where wood and timber are scarce and high in price, it would be very far from profitable or desirable to plant in sections where lands covered with virgin forests of the most valuable timber can be bought for from $1 to $5 per acre, as they can be in many of the States. But even in these sections it is important that the principles of forestry should be enforced to prevent the destruction, so prevalent, by fire and the lumberman's waste, for at the present rate of cutting in the lumbering districts these virgin forests will in a few years be laid under contribution to supply the great markets of the country.

Forestry has proved remunerative in Europe, where it has been under government patronage and protection for 150 years, and where wood and timber are in good demand at high prices. There is no guesswork about the results there. The book-keeping is thorough and the balance-sheet reliable. Prussia, from her 6,000,000 acres of state forests, receives an annual net income of about $7,000,000. Saxony, from her 400,000 acres of forest lands, receives an annual net income of about $1,250,000. Bavaria, from her 3,000,000 acres, receives annually, after paying all expenses, a net profit of $4,500,000.

ALSATIAN FORESTS.

The report of these forests, made the present year by United States Consul Ballow, of Kehl, to the State Department at Washington, gives some important facts bearing upon the profits realized from systematic, scientific forestry, to which I am indebted for the following facts:

The forests of Alsace-Lorraine cover 35.59 per cent. of the whole territory. The most important of these are in the Vosges mountains, the highest peak of which is 4,300 feet. They were the most important in France before the war of 1870, and are

only excelled by the forests of Baden in Germany. The government and the communities are the principal owners of all these forest lands, amounting to 1,109,660 acres. The government owns of these 336,600 acres—*i. e.*, the government of Alsace-Lorraine; the government and the communities, 42,955; the communities, 496,040; and private parties, 234,665 acres. The government forests are managed by a chief of foresters, with a salary of $2,200, three conservators at $1,800, nine inspectors at $1,600, 63 chief foresters at $1,200, and 275 common foresters and guards at $400 to $500 per annum. Chief foresters and common foresters have free lodging and fuel in addition to their pay.

All forests, no matter to whom they belong, are placed under the supervision of the forest administration, and the latter regulates the cutting. Not even owners of private forests are allowed to cut down their own wood without the consent of the government.

For the cutting and replanting of a forest in the Vosges a period of 120 years is required. During that time the forest is depopulated and renewed.

The average annual gross receipts of the government forests of Alsace-Lorraine, for the last ten years, was $1,786,948, and the average annual expenditure for the same time was $596,684, leaving an annual net income to the government of $1,192,114, or $3.20 per acre.

A large proportion of the forest lands of Europe, and especially in Prussia, has been reclaimed from almost barren wastes, or were lands naturally of little value for agricultural purposes. Their administration furnishes employment to many thousands, yields to the government a large annual income after paying all expenses, even to the support of schools of forestry, experiment stations, etc., while by their climatic and hydrographic influence they render the country more productive and better able to support a dense population.

REFORESTING WASTE LANDS.

In the New England and middle States forests may be grown with little expense and trouble. Fields worn out and abandoned or cleared lands not fit for agriculture and yielding little or no pasture can often be renewed by simply protecting them from browsing cattle and fires. Trees spring up naturally and thickly, and often of good variety. A little expenditure of time and money in sowing or planting the seed of valuable timber trees will insure the growth of a crop that is sure to yield a good return. The wooded area of some of the New England States has increased in the past few years through the mere neglect of the worn out and apparently useless lands, and the lumber product of second-growth white pine is now from 300,000,000 to 400,000,000 feet annually. Frequent examples in New England attest the fact that the rocky hillsides, when protected, soon become covered with a dense second growth of young trees that hide the barrenness of the scene and afford a protecting shelter to the adjoining fields.

But these embryo forests are worthy of more attention than to be simply let alone. Intelligent care in thinning and pruning and utilizing as the growth warrants may add a hundred fold to the value.

A farming country should have not less than 25 per cent. of its area in woodland. In general, outside the prairie States, this proportion can be set aside from lands of little or no real value for agricultural purposes. There is hardly a farm in New England of 100 acres that would not be greatly augmented in value by devoting this proportion to the cultivation and maintenance of woodland, and the same may be safely affirmed of every other portion of the country. And when farmers come to realize this fact they will no longer look upon the wood lot as of little comparative worth, ready to be cleared on the first demand, but will place a just estimate upon its value, and will discern its influence on the rest of the farm in protecting from destructive winds, in holding moisture against the droughts of summer, in modifying the extremes of heat and cold, in rendering the fruit crop surer, and in being, to a certain extent, the conservator of health, while it yields abundantly of its product for the farm.

The words of the late Horace Greeley, in speaking of the available opportunity for timber culture in Westchester county, N. Y., are well worth quoting here. He says:

"Were all the rocky crests and rugged acclivities of our country bounteously wooded once more, and kept so for a generation, our floods would be less injurious, our springs unfailing, and our streams more constant and equable; our blasts would be less bitter, and our gales less destructive to fruit; we should have vastly more birds to delight us with their melody and aid us with our not very successful war with devouring insects; we should grow peaches, cherries, and other delicate fruits, which the violent caprices of our seasons and the remorseless devastations of our visi-

ble and insect enemies have all but annihilated; and we should keep more cows and make more milk on two-thirds of the land now devoted to grass than we actually do from the whole of it. And what is true of Westchester is measurably true of every county in the Union."

FORESTRY ECONOMIES.

Statisticians have furnished us with alarming facts relating to the consumption of forestry products in this country and the consequent rapid decrease of our forest area. These facts have been widely published through official reports and commented upon by the public press. Yet so important are they as the basis for urging upon the people and the National and State governments the necessity for adopting and enforcing measures looking to the prevention of timber waste and the preservation of necessary forest areas that I venture to repeat some of them here.

Prof. Egleston, Chief of the Forestry Bureau at Washington, from the mass of statistics gathered on the subject, estimates the total value of all the annual products of our forests at not less than $800,000,000, outmeasuring the value of our great cereal crop, that of corn; about double our wheat crop; more than that of our crops of hay, rye, oats, barley, buckwheat, potatoes, and tobacco taken together, and ten times that of all our mines of gold and silver. Prof. Sargeant made the estimate for 1880 of more than $700,000,000.

The capital invested in the United States in the lumber business – *i. e.*, in the business of manufacturing lumber in 1880, was, according to the census return, $181,186,122. The total value of our lumber product for that year is given at $233,367,729, while the estimated value of the cord-wood used for domestic purposes was $321,962,373.

The New England States had invested at the same time in the lumbering business $16,641,326, and produced a lumber product valued at $19,271,914; and the value of the cord wood consumed for domestic purposes that year amounts to $16,242,801.

FOREST FIRES.

In addition to the contribution of our forests as above indicated, they suffer an enormous loss from fires and browsing animals. The forest area burned over in the census year of 1880 in the United States, as estimated by Prof. Sargent, was 10,274,089 acres, involving a loss of $25,462,250, beside the incalculable injury done to the soil, which in many instances rendered the burned region incapable of reforesting. "Fire and browsing animals," says Prof. Sargent, "inflict greater permanent injury upon the forests of the country than the axe, recklessly and wastefully as it is generally used against them."

RAILROAD TIES.

The large and rapidly increasing demands made upon our forests in the supply of railroad ties alone are impressively shown by Prof. Egleston in his report on forestry issued last year, to which I am indebted for the facts following: There is now in use in this country about 150,000 miles of railroads, which have required 396,000,000 ties, or the wood supplied by 3,390,000 acres, an area larger than that of the States of Rhode Island and Connecticut. Estimating that ties need to be renewed on an average once in seven years, there must be drawn from the forest annually 56,571,428 ties, requiring the timber growing on 565,714 acres. Allowing 30 years as the time necessary to produce trees of proper dimensions for ties, it will require 16,971,420 acres of wood land to be kept constantly growing as a kind of railroad reserve in order to supply the annual needs of the existing roads. This constitutes an area larger than the States of New Hampshire, Vermont, and Massachusetts combined, or the States of New Jersey, Maryland, and Delaware, with the addition of Connecticut. It is more than 4 per cent. of the total area of wood land in the United States, exclusive of the Territories, and 3 per cent. of the area in the States and Territories together. With the rapid extension of our railroad systems, these figures will be proportionately increased. From these facts it would seem that the subject of forestry should receive the most favorable consideration from railroad corporations.

THE WHITE-PINE SUPPLY.

The general awakening to the interests of forestry among the people of the originally wooded States came largely through the wide-spread publication a few years ago of the alarming facts relating to the destruction and fast disappearing of white-pine forests of the United States and Canadas. When the people were convinced by the reports of the statisticians that the supply of this most valuable and extensively used

timber would last but a few years at the rate of consumption going on, and that they would have to look ere long for other timber to take its place, active inquiry began as to our whole timber supply, the comparative value of the different kinds in the mechanic arts, how long these would last on the present basis of demand, and what the prospects were for the future.

When the forestry bulletins, issued by Prof. C. S. Sargent from the Census Department, announced that in both the upper and lower peninsulas of Michigan there remained of standing white-pine timber, suitable for market, but 35,000,000,000 feet, board measure, and that in the census year of 1880 there had been cut in the State 4,396,211,000 feet, requiring only eight years at this rate to exhaust the supply; that in Wisconsin there were standing 41,000,000,000 feet, with a cut of about three billions (2,097,299,000) feet for that year, leaving a supply that would last but fourteen years; that in Minnesota there were remaining 8,170,000,000 feet, and that 541,000,000 (540,997,000) were cut in the census year, leaving a supply for fifteen years, that at this rate the supply of white-pine lumber would be exhausted in these three States in the brief period of about twelve years, the question of the future supply of this most valuable timber became serious to the business world.

The late James Little, of Montreal, in 1882, said of the supply of white pine in Canada that he had consulted with the best authorities, and was pursuaded that, at the rate of cutting then going on, the whole supply of the provinces of Quebec, Ontario, New Brunswick, and Nova Scotia would be used up in about ten years. According to these estimates, then, the supply of white pine will soon be exhausted, and the mechanic arts will have to look to other fields for their supply of wood and timber. In view of this vast industrial interest the protection and conservation of our forests demands the earnest attention of our people and of the National and State Governments.

FORESTRY EDUCATION.

We have no schools as yet in this country which provide for a systematic training in forestry. The time for this, perhaps, has not ripened. The foundation, however, has been laid through the establishment of a few experiment stations, the general agitation of the question by forestry, agricultural, and horticultural associations and the public press. One of the most effective means employed thus far has been the institution of

ARBOR DAY.

Tree-planting on Arbor day, for economic purposes in the great West, has given to the prairie States many thousand acres of new forests, and inspired the people with a sense of their great value, not only for economic purposes, but for climatic and meteorological purposes as well. The celebration of Arbor day by the public schools in several of the older States by the planting of memorial trees, as originated at Cincinnati in the spring of 1882, and generally known as the "Cincinnati plan," has done much also to awaken a widespread interest in the study of trees; and this annual celebration promises to become as general in the public schools and among the people as the observance of May day in England. "Whatever you would have appear in the Nation's life you must introduce into the public schools." Train the youth into a love for trees, instruct them in the elements of forestry, and the wisdom of this old German proverb will be realized.

AGRICULTURAL COLLEGES.

In 1862 the National Government donated to the several States 9,600,000 acres of the public domain for the support of colleges of agriculture and the mechanic arts. There are forty-two of these schools that have received their *pro rata* of these lands, or the right to them. With a few notable exceptions the subject of forestry is not known in their curriculum. Every agricultural school in the country should give a prominent place to this study. While it is not feasible, nor perhaps advisable, yet to give an extended course in forestry instruction, it seems to me inexcusable not to give such general instruction as to lead the student to appreciate and care for the wood lot as well as the tilled field. The growing of timber is like the growing of a crop, to be cared for intelligently, to be utilized wisely, and to be cut and used when ripe for it. In connection with every one of these colleges there should be a forestry experiment station, conducted with a special view to the needs of the locality in which the school is situated. The advantages of these stations are obvious when we consider the almost absolute want of reliable scientific data in this country on which to found a general system of forestry management.

GOVERNMENT LANDS.

The National Government still owns about 85,000,000 acres of forest lands. These are without effective protection against the depredations of lumbermen. Hundreds of thousands of dollars' worth of timber is stolen annually from the public domain, and the destruction by fire is going on unchecked. Portions of these forests lie on the headwaters of the most important rivers of the continent, and their destruction would cause incalculable loss to the Nation. These forest lands should be promptly withdrawn from sale, efficient measures should be adopted to protect them against loss by theft and fire; such portions as are deemed necessary to the water supply and for climatic purposes should be dedicated forever to forest preserves, and the balance put back upon the market at a fair valuation. In the meantime, such timber should be sold to the lumbermen as the business demand and the interests of forestry might require. This important interest should be placed, by law, in charge of the Forestry Bureau of the Agricultural Department, with ample appropriations for attaining these ends.

I have thus called your attention to some of the features of forestry that I deem most worthy of consideration. Your papers and discussions will embrace a much wider field, and I trust that we shall come to some definite conclusions, and take definite action with reference to some things that should be done the coming year in furtherance of our cause.

In this connection, and finally, I venture to suggest—

1. That action be taken by the Congress with regard to securing appropriate legislation by the National and State Governments.
2. That plans be devised and methods adopted for promoting forestry education in our institutions of learning, for the continued spread and still more efficient celebration of Arbor day, and the organization of local forestry associations.
3. That special consideration be given to the relation of forestry to commerce—*i. e.*, railroads and navigable streams.
4. That steps be taken toward collecting and classifying reliable statistics in America (the United States and Canada) relating to our forests, and making them a part of our annual report, stamped with the authority of this Congress.

CONCLUSION.

"I have written many verses," says Holmes, "but the best poems I have produced are the trees I planted on the hillside which overlooks the broad meadows, scalloped and rounded at their edges by loops of the sinuous Housatonic." May the work done at this session of the American Forestry Congress result in adding many a like poem to the landscape, and in adding a powerful impetus toward the protection, the conservation, and wise utilization of our forest wealth.

At the close of the President's address, the reading of the minutes of the last meeting being next in order, on motion, the reading was dispensed with.

As the call was next made for the report of the Recording Secretary, the absence of Dr. Hough, hitherto always present at the meetings of the Congress, was perceptibly felt. His recent death was announced by Mr. Egleston, and a committee was appointed for the purpose of making proper expression of the sentiments of the body in view of his decease.

Mr. George Noyes, of Boston, was then chosen temporary Secretary in place of Dr. Hough.

The report of the Corresponding Secretary, Mr. B. E. Fernow, was then read as follows:

REPORT OF THE CORRESPONDING SECRETARY.

When a year ago it was your pleasure, against my strong advice, to entrust me again with the office of Secretary to your Association, I undertook once more the task with that diffidence which the magnitude of the work before me, as in comparison with the insufficiency of means and facilities at my disposal, would naturally add to a proper conception of my own shortcomings.

I assured you that my good will would have to stand for what I could not bring to the office, namely, experience in this class of work, a large personal acquaintance with the workers in the field, and plenty of time for correspondence with them, in order to bring about united direction of work, and to keep public sentiment warm to the interests of our cause.

These requisites being more or less absent, as well as the funds necessary for any diffusive propaganda, the slow progress in our work of reform must be understood. We can only expect to work in a small way and very gradually break the ground, until more means are at our disposal for specific work and the diffusion of our publications to a larger extent.

It has been my suggestion that the proceedings of this Congress would find a wider range of usefulness if, instead of being published in one volume, their publication would be distributed through a series of bulletins, in which could at the same time be noted the progress in the development of the forestry movement, and constant intercourse could be kept up between our friends. It was also expected that the cost of such publication would be largely covered by subscription. With this in view, the January bulletin was prepared in a rather more expensive style than at first contemplated. But, while kind commendations of the work were not lacking, sufficient patronage could not be secured to continue these issues on a subscription basis. In consequence, the proceedings and papers read at the Saratoga meeting remain still unpublished; the same is true of those read at Montreal and Cincinnati, to a large extent. It is suggested that these should be carefully sifted and the most valuable papers published, together with the report of the present meeting.

As our work can bear fruit only by a liberal diffusion of our published proceedings the most important problem for solution remains: How shall a more general and generous support be secured? In this we must keep in mind that our Congress is still more or less a benevolent society, which must look for their financial support to the generosity of their members and patrons. It will be different when this Congress represents an association of professional foresters, who in joining together advance their own personal aims and the interests of their profession. At present we are only a reform association, and cannot accomplish anything without expending on the education of the large mass.

The next problem in importance is, "How can we make our work most valuable?" and in this the possibilities are only limited by our facility in solving the first. Allow me, however, to point out a few possibilities of improvement. First of all we must personally produce at our meeting only work of some special value. In view of the still frequently vague writings on the subject of forestry I would repeat the injunction not to rely on mere authoritative statements. Generalities on forest preservation or forest destruction and forestal influences have become trite and their constant reiteration without positive data will dull the interest of listeners and readers, create suspicion and defection. We need definite, well-authenticated local observations, arrived at by well-described scientific methods; we need methodical work in establishing the conditions of growth for different species, their behavior towards the soil and towards each other in different soils, their rate of growth at different periods of life under different conditions. In fact, besides making propaganda, we should by concerted effort establish the principles upon which the forestry we advocate is to be carried on. Therefore, secondly, we ought to find means of engaging those men who by their profession are led to such studies as are germane to forestry problems to give more definite attention to these problems; we ought to count them in our ranks, and whilst their membership in our Congress will lift its work to a higher level their individual efforts will acquire that force and momentum which such an association will impart.

Thirdly. Our work in promoting proper legislation, in inducing the establishment of Arbor days and procuring other means of advancing our cause, must be largely done by committees during the intervals between our meetings. It is therefore of the highest moment that whoever accepts the appointment to such committee work should be imbued with the importance of such a trust, and not undertake it unless he is willing and can with sincerity devote himself to its discharge. Except for the committee on Arbor day and the painstaking work of Mr. Elizur Wright on the Mississippi reservoir committee, we have not done well in this respect.

In conclusion I would point out that the more the question of forestry is appreciated the more will grow a necessity of organizing local interests. In this question the Eastern mountain regions have different conditions, and consequently different aims to pursue from the treeless States of the West. The interests of the Northern States, with a largely denuded and decreasing forest area, differ from those of the vast forest wealth in the South.

We should as members of this Congress individually promote such association of local interest, by which means a systematic forestry may be much sooner secured in the aggregate than by an association which lacks the incentive of a direct benefit to a particular locality. Eventually this Congress will then be made up of the delegates from local associations, meeting to further the interests common to all.

Understanding this to be one of the duties of this Congress, your president and secretary undertook in the beginning of the year to organize the forestry interests in the

State of New York, taking advantage of the efforts that had been made in this direction by other parties without result. An enthusiastic meeting at Utica, called almost on the spur of the moment, inaugurated the New York State Forestry Association, which, but for some misunderstanding in its ranks, might have done better work in promoting the Adirondack forest legislation.

The Forest Commission for the State of New York has at last been established, and, with an appropriation of $15,000, should be able to show soon how a proper State forest administration may be organized, and, with what is left of State timber lands, should soon pay at least its own maintenance.

This year has also witnessed, under most favorable auspices, the formation of a Forestry Association in Colorado. So promptly and so well was its work done that, after a propaganda of a few months, Colorado could boast of the first Forest Commissioner in the States appointed to manage her forest reserves.

The Ohio Association has also succeeded in having a commission appointed for the purpose of advising in the management of her forestry interests.

California, too, has established a Forest Commission to experiment and study the requirements of different timber trees and similar questions of forest culture.

Thus it is shown that the agitation which we have carried on for now three years has found its reward and expression in a practical manner in all parts of the country.

As to the status of our Association, a few remarks will suffice.

From our member-list I find that we have 21 life members. We carry on our Treasurer's book 68 annual members, making a total of 89 members; but if we should apply the test of paid-up dues, this number would shrink considerably. We are not strong in numbers and must make up this deficiency in energy and earnest work. We mourn, therefore, the more the loss of our Recording Secretary and of the active and vigorous support of Dr. Hough. Perhaps no man in the Union deserves more credit for having not only invited timely attention to the needs of American forestry, but for the indefatigable industry and persevering energy with which he gathered valuable information and diffused it throughout the Union. Though not a man of original research, his name will lastingly be known among the pioneers of American forestry.

From the Treasurer's statement you will learn the modest sums which have been spent to pay for the issue of two bulletins of 2,000 copies each, the preparation for two annual meetings, and the incidental expenses of correspondence.

Our last two annual meetings have largely lacked the local support which must needs be enlisted to lend impressiveness to our proceedings. The welcome which we have met in this centre of intellectual life, and especially by the gentlemen of the Massachusetts Horticultural Society, must be the more gratefully acknowledged.

From this meeting we hope and expect fresh life and new impulse by enlisting the energetic and earnest work for which New England men have ever held the highest reputation.

BERNHARD E. FERNOW,
Cor. Secretary.

In the absence of the Treasurer his report was read, as follows:

REPORT OF THE TREASURER.

John S. Hicks, Treasurer, in Account with American Forestry Congress.

SEPTEMBER 15, 1885.

Received by Chas. Mohr, treasurer's balance		$203 47
life memberships		210 00
donation, Jos. S. Fay		10 00
members' dues and fees		83 00
bulletin subscriptions and advertisements		26 30
Expended:		
Stenographer's bill	$65 00	
Printer's bills	289 80	
Stationery	37 19	
Clerk hire	10 00	
Postage and expressage	85 07	
	487 06	
Balance on hand	46 21	
		533 27

Specification of Expenses.

Saratoga meeting, printer's bills	$10 60	
postage	19 10	
		29 70
Boston meeting, printer's bill and electrotypes	36 50	
postage	34 80	
		71 30
Bulletin No. 2, printer	63 32	
postage	8 50	
		71 82
Bulletin No. 3, printer and electrotypes	179 38	
postage	17 35	
		196 73
Letterheads and envelopes	30 42	
Rubber stamps	1 50	
Sundries, stationery	5 27	
		37 19
Sundry postage and express		5 32
Clerk hire		10 00
Stenographer		65 00
		487 06

Showing a balance on hand of $46.21.

After the appointment of sundry committees, the Congress adjourned to 2 o'clock p. m.

AFTERNOON SESSION.

The President called the Congress to order at 2 o'clock, when the Corresponding Secretary read communications from several persons expressing their inability to be present at the meeting of the Congress. The first was from Dr. Oliver Wendell Holmes, who, while expressing his regret that he was unable to attend the Congress, said he hoped the Congress would have influence sufficient to induce the country to retain "leaves enough to hide its nakedness, of which it is already coming to be ashamed." Letters of regret were also read from Prof. H. M. Seeley, of Middlebury College, Vermont; Governor Harrison, of Connecticut; Senator Warner Miller, chairman of the Forestry Committee of the United States Congress; Gen. W. Ward; Hon. Charles Francis Adams; Prof. C. K. Adams, of Cornell University; the Governor of Vermont, and Mr. H. C. Putnam. All expressed sympathy with the objects of the Congress and the hope that the session would be a successful one.

RESOLUTIONS IN REGARD TO DR. HOUGH.

The committee appointed in the morning in view of the death of Dr. Hough reported the following resolutions as expressive of the feelings of the Congress:

Resolved, That this Forestry Congress has heard with profound regret of the recent death of Dr. Franklin B. Hough, its Recording Secretary, and desires to place on its records its sense of obligation to him, not only as one of the founders of the Congress, and one of its most efficient officers from its beginning, but as one by whose indefatigable labors and zealous interest in the cause of forestry that subject was brought to the attention of the Congress of the United States, so as to secure favorable action by that body tending to the preservation of our wood lands, and whose exhaustive inquiries and comprehensive reports furnish a body of information on forestry unsurpassed for value and interest by any publication in the English language. The whole country is indebted to him as one of the chief instruments in arousing the people to a sense of the importance of maintaining a proper extent of forests, and for the interest in the subject which is already manifested.

Resolved, That this minute be placed upon the permanent records of this Congress, and that a copy of the same be transmitted to the family of Mr. Hough.

Remarks were made by several members in regard to the character and services of Dr. Hough, and the resolutions were adopted unanimously.

FACTS IN REGARD TO THE PRESENT STATE OF OUR FORESTS.

A large colored chart was suspended on one side of the platform, which had been prepared in the office of the Forestry Division of the Department of Agriculture at Washington, for the purpose of showing at a glance, by means of different colors, the extent of farmed lands, forests, and waste lands in each State and Territory.

Mr. Egleston, Chief of the Forestry Division, read a brief paper, in part explanatory of the chart, and giving some particular facts of special interest in connection with the subject. He spoke of the great difficulty of obtaining exact and satisfactory knowledge as to the extent of the forests, or the rate at which they are consumed. It is a vast country with which we are concerned, portions of it yet but sparsely settled, and much of it altogether unsurveyed. The Agricultural Report of the Census was a report as to farms, and took no account of the large area lying outside of the appropriated farms of the country. The Census of 1880 was the first to undertake an inquiry into the extent and character of the forests, and the volume prepared under the direction of Professor Sargent would be resorted to often as a treasury of facts on this important subject. Mr. Egleston gave some startling figures in regard to the consumption of the forests which is taking place.

Mr. Little, of Montreal, the well-known lumberman, who is equally well known for his intelligent views and his enthusiastic interest in forestry, while expressing his pleasure in listening to the statements of Mr. Egleston, said that the lumbermen were to blame for most of the forest fires. It was their careless and wasteful methods of lumbering that made forest fires possible. He himself had not lost more than one per cent. by fire in all his lumbering operations. It was the limbs of the trees, left by the lumbermen to wither and dry where the trees fell, instead of being removed, which afforded the ready fuel for any chance spark that might fall from the smoker's pipe or the unextinguished camp fire.

Mr. Merriam, of New York, corroborated the opinions expressed by Mr. Little.

The remainder of the afternoon was occupied in welcoming those who had come to the Congress as accredited delegates from various States and listening to the reports which they had to give in regard to the condition of forestry in the States represented by them. All the New England States were thus represented, together with others as distant as Nebraska and California. Applause broke out when ex-Governor Morton announced that as the result of premiums offered in Nebraska for the greatest number of trees planted on Arbor day 7,000,000 trees were planted in a single day.

The venerable Elizur Wright, active and enthusiastic as though forty, instead of eighty years old, made a very interesting statement in regard to the Middlesex Fells, and hoped the Congress would influence the Legislature to make this forest the property of Boston for the purposes of health and recreation.

EVENING MEETING.

The evening session of the Congress was designed to be of a more popular character than those of the daytime. Governor Robinson was present, and, on being introduced to the Congress by President Higley, addressed the body, as follows:

MR. PRESIDENT AND GENTLEMEN OF THE FORESTRY CONGRESS: Invited some weeks ago to be present here for a few moments to say something of greeting to you, in reading over the journals of this evening I found the most worthy chief magistrate of the city had already extended the welcome of the city of Boston to the Congress, and, knowing her abundant hospitality, I felt it would be almost useless for me to bid you welcome to the larger people. But one is so soon out of the woods in Boston—I do not mean politically—we feel like introducing you to something of the woodlands

outside, and so, speaking for the larger number of people outside the city, I bid you welcome to the State. During last winter a resolve was passed by the Legislature asking me to appoint five gentlemen to attend this Congress. I assure you it was a pleasure to me to do so, and I wished they might be able to be of some use to you in your deliberations. It is, therefore, with heartfelt satisfaction that I see these five gentlemen are present to attend to their duties. [Applause.] Nor would you expect anything different from Massachusetts or her subjects. She has the right to claim the position of being the first State to take into consideration this question. At the beginning of the present century the old State society of agriculture offered prizes for the development of forest growth, and so it has continued. There is a gentleman here who is credited with a magnificent sum for his devotion in planting trees. In 1837 the Government ordered a survey and inquiry into the growth of all the woodlands of the State. You know it resulted in the report of Mr. G. B. Emerson in 1846 to Governor Briggs, a work which deserves study at the present time. Indeed, it is a classic, as it were. As early as 1818 our people thought it to be of interest to look to the shipping interest, and so they provided that the Agricultural Department should provide encouragement for the growth of the oak, and that provision remains on the statute book to-day. Perhaps the agricultural societies do not know this at this time; perhaps because ship-building is not now of such great importance. Then in this State we have offered encouragement by the exemption of taxation, under certain conditions, to the owners of trees. Then penalties have been imposed for the wanton destruction of trees by fire. In 1882 an act was passed authorizing the cities and towns to raise money to make the forest lands public domain, so that the people may have the pleasure of them perpetually. Nor is that all. In 1884 it was my privilege, in addressing the Legislature, to bring the subject before the attention of that body, and it was deemed advisable to get every fact of importance, and the officer now charged with the State census is collecting all the statistics and data on this question, that it may be laid before some future Legislature. That is a most important step. Knowing the gentleman in charge of the census bureau, you know the work will be well done, and that the results will be entitled to confidence. Others far more at home on this subject than I am, and very likely gentlemen who have had more leisure recently to devote to the question, will address you and touch on these topics. But any man with eyes in his head and brains to direct his intellect knows the value of growing forests, even in these thickly-settled States. Time was when we were on the farm that we thought we were doing the highest service by destroying the trees, and year by year farmers have done all they could in reclaiming, as they call it, land that had better be left alone in the forest. [Applause.] Agriculture is not the pastime in Massachusetts that it is in the Western States, and those of us who began life with those days when we rode the horses to the stump know what it is. I say all such land would have been better land if left alone and the fallow kept away. Experience is proving the truth, because it is a fact that the acreage of the forests in the States during the last half century has not diminished. Certain lands have been abandoned for tillage, although the capacity for production of trees may have been seriously diminished. The whole question of water supply only needs to be touched upon. Boston may well say we are most interested in some practical solution of the question. Boston wants the clear water of the country from the woody forest, from the shade of the forest, where the air sweeps from every breeze. [Applause.] And we in the cities want life, energy, muscle, and spirit, and we expect to get it from the pure air. Start some fine morning out of sultry Boston and go to the woods of New Hampshire and Maine and try the effect, and you will come home ready to demonstrate that the air of the forest is good. Transplant that forest as near the city as you can, and let the young child and the old man breathe good air in the morning, at noon, and in the evening, and it will be a luxury. Then, in material concerns, the manufacturer who depends on water power is interested, so we in New England hope that out of this meeting the States will find they have a common interest. There is something that we may do in all places. We may not make a forest, for we may not own land enough for one, but wherever there is a dwelling, and wherever there runs a road or stands a school-house, a church, or a railway station, or a water trough beside the road where the animal stops to drink, there is a place for a shade. Then, if the animals could speak, how they would bless the man who planted the tree beside the water, so that he could enjoy the cool shade while he took his draught. We are glad to welcome you to Massachusetts. The Commonwealth gives you greeting, and hopes for a great success. [Loud applause.]

The Governor was followed by ex-Governor Morton, of Nebraska; Major Ben: Perley Poore, Hon. George B. Loring, and Dr. B. G. Northrop.

A letter from Hon. Warner Miller was read, expressing regret on account of his in-

ability to attend the Congress, and presenting for its consideration a bill which he had prepared and proposed to introduce at the approaching session of the National Congress, providing for the withholding from sale of all public lands which are timber lands and the appointment of a commission to survey these lands so as to determine which may properly be disposed of and which shall become permanent reservations. The letter and bill were referred to a committee, who subsequently reported a recommendation of the general provisions of the bill for adoption by the General Government, and the report of the committee was adopted.

Colonel Merriam, of New York, offered a resolution recommending the planting of memorial trees by the army posts of the country in connection with the commemorative exercises of Decoration day. The resolution was unanimously adopted.

SECOND DAY.

That was a remarkable scene presented to view on the opening of the second day's session of the Congress. The Hon. Marshall P. Wilder, known throughout the country and beyond it for his enthusiastic interest in horticulture, and who had recently celebrated his eighty-seventh birthday, was on the platform. Close at hand were Hon. Elizur Wright, in his eighty-second year, and Hon. Joseph S. Fay, who, not yet in his eighties, had come to invite the Congress to take a practical lesson in forestry by paying a visit to his planted forest of 200 acres and more on the southern shore of the Cape. And there were the white beards of ex-Governor Morton, Hon. Mr. Joly, of Quebec, and others, who were the leaders and enthusiasts in this Forestry Congress. Indeed, it might almost be said that the enthusiasm of the members and their manifest earnestness in the cause of forestry were proportioned to their age. This was like a reversal of the usual order of things, as we expect old men for counsel but young men for action. Is it because, as the lives of the trees are measured by centuries and the influences of forestal agency are developed slowly and cover large spaces, so it requires the observation of the larger part of man's ordinary lifetime to give him a proper apprehension of the importance that attaches to trees, and especially to forests?

Mr. Wilder, on being introduced by President Higley, was received with applause. Allusion having been made to his age in the President's remarks, he said he would never be so old as not to take interest in the object of this organization. He welcomed them to the Massachusetts Horticultural Hall in Boston. This society, he said, was the first of its kind incorporated in the country, and was the parent of many others. It had been the means of introducing ornamental trees, which originally came from the forest, and it was of the highest importance to protect the forests for the many useful purposes the timber served mankind. He said: "Go on; press on in your noble work, and future millions shall remember you with gratitude long after you have passed away." [Applause.] He said he had been a lover of nature from his youth, and hence his interest, and he loved everything in nature—the balmy spring, the glorious summer, the mellow autumn—and he loved dearly to be remembered by those who had for their object, as his hearers had, the health and happiness of the human race.

The first paper read this day was one by Mr. Egleston on "Forestry Legislation in the United States," in which he traced its progress from the earliest settlements of the country to the present time. He considered forestry legislation in the two aspects of laws for the protection of forests, as property, from theft and depredation by fire, and laws for the production or extension of forests by bounties on tree planting. The substance of the laws of each State was given, usually with the date of their enactment.

The Hon. M. Joly, of Quebec, in speaking on the forest economy of Canada, bore emphatic testimony to the practical usefulnesss of this Congress thus early in its history, showing how the Legislature of Canada had adopted the suggestions of the Con-

gress, and had thus placed Canada in advance of the United States in respect to forestry. In 1883 the Province of Quebec carried out the suggestion of this Congress by causing all lands unfit for agriculture to be set apart for the cultivation of timber. The Government would not allow any of its land which is unfit for cultivation to be allotted to the settler. It was a cruelty to allow him to settle on such land.

SMOKE-CONSUMING DEVICES.

A very interesting paper was read by Mr. Lander, superintendent of motive power on the Old Colony railroad, on the subject of "Smoke-consuming Devices for Locomotives." He gave a history of the attempts to arrest the sparks of locomotives as a relief to passengers, and for the purpose of preventing fires liable to be occasioned by them. He described the difficulties to be surmounted by any successful contrivance, and affirmed that these had finally been overcome, and that there were now such effective appliances that there is no good reason why there should be any further annoyance or danger from the sparks of locomotives.

This paper was of such interest and practical importance that it led to an animated discussion, and to the reference of the subject to the Committee on Legislation, who were charged to gather information on the use of spark arresters, and lay it before railroad commissioners in the several States and enjoin them to enforce the use of such appliances on all locomotives running through wooded regions.

STANDING COMMITTEE ON LEGISLATION.

The President was directed to appoint a standing Committee on Legislation, for the purpose of drafting bills touching forest legislation which are most desirable for the present. The committee were authorized to associate with them in each State proper persons who would co-operate with them.

ONTARIO COMMISSIONER'S REPORT.

An important report was received from the Hon. R. W. Phipps, forest commissioner of Ontario, giving facts of much practical interest.

AFTERNOON SESSION.

In the afternoon a paper was read by Hon. John E. Hobbs, of Maine, on the dependence of the lumbering interests upon systematic forestry. The paper abounded with interesting facts in regard to the production of lumber and the sources of future supply. The necessity of planting and cultivating forests was strongly urged.

A paper of much practical interest on the cultivation of the red cedar and the osier willow was read by Mr. Edmund Hersey, of Hingham. Mr. H. exhibited some shoots of the willow grown the present year which were nearly ten feet in length. They were grown on elevated and comparatively dry ground which had not been enriched.

Mr. Fernow read an interesting paper on the practicability of making use of the waste material of the lumberman as a fertilizer for the agriculturist. He said the experiment in Canada had already proved successful.

PLANTING OF EVERGREENS.

Mr. W. C. Strong read a paper on the transplanting of evergreens, giving his experience as to the best time of the year in which to do this work. This he has found to be in August, rather than at an earlier or later period, and he gave some physiological reasons in favor of summer planting.

ARBOR DAYS.

The subject of Arbor days had a hearty reception this afternoon, being brought before the body in a paper by Mr. Egleston, who urged that the observance of Arbor day was properly not for the prairie States alone, where it originated, but that it was needed in all the States, and was one of the most efficient means of promoting the cause of forestry throughout the country.

Mr. Peaslee, of Cincinnati, also sent a paper on the subject of Arbor day, in which he treated of the Ohio plan of connecting its celebration with the public schools and its happy results.

A standing committee on Arbor day was appointed, consisting of Dr. B. G. Northrop, Mr. Egleston, and Mr. J. B. Peaslee.

EVENING SESSION.

At the evening session the committee, to whom was referred the proposed bill of Senator Miller for national legislation to preserve a proper amount of the public timber lands, reported in the form of a resolution, commending the bill and referring it to the committee on legislation.

Rev. Dr. Mayo then enlivened the meeting by reading a paper in a somewhat different vein from the ordinary discussions, entitled the modern "Babes in the Woods."

The Hon. Norman J. Coleman, Commissioner of Agriculture, was then called out, and addressed the Congress for half an hour in a very earnest and spirited manner. He avowed himself fully in sympathy with the objects of the Congress. He desired the aid of the Congress. He wished to do some practical forestry work. But the Department of Agriculture was hampered in its forestry work by lack of means. Congress appropriated only $10,000 for the work needed throughout the whole country, when the single State of New York appropriated $15,000 for her own needs alone. He would have them urge their representatives in Congress to appropriate $50,000, and if ten times that were appropriated it would return a hundred fold. The remarks of the Commissioner were listened to with great attention, and at the close were applauded.

THURSDAY MORNING.

The two previous days, with their three sessions each, left but little of the indoor business of the Congress to be done, except that of a routine character and the choice of officers for the ensuing year.

Officers were chosen as follows:

President, Hon. Warren Higley, of New York.

First Vice-President, Hon. H. G. Joly, of Quebec.

Second Vice-President, Hon. J. Sterling Morton, of Nebraska.

Corresponding Secretary, Mr. B. E. Fernow, of New York.

Recording Secretary, Dr. N. H. Egleston, of Washington.

Treasurer, Mr. J. S. Hicks, of Roslyn, L. I.

Hon. B. G. Northrop, of Connecticut; Hon. William Little, of Montreal; Hon. J. B. Grinnell, of Iowa; Hon. J. G. Knapp, of Florida, and Mr. R. H. Warder, of Ohio, were chosen to be with the other officers of the Congress an Executive Committee.

MIDDLESEX FELLS.

Hon. Elizur Wright again urged the Congress to visit Middlesex Fells and see the capabilities of the tract from a forestal point of view. Here were 4,000 acres, the forests on which and the now ample water supply were threatened with destruction unless the tract could be purchased from the present proprietors and made a public domain. Mr. Wright said this was the only place in the immediate neighborhood

where the woods can be preserved and the water kept pure. There was enough pure water there to supply a million people with four and a half gallons daily.

PUBLISHING FUND.

Under the lead of the President an effort was made to secure a special fund for the purpose of publishing the valuable papers which had been read and others which had been prepared but could not be read for lack of time. In response to the President's invitation quite a number of those present subscribed $20 each to the proposed fund.

NEW ENGLAND LEGISLATIVE COMMITTEE.

A committee of twelve was appointed with special reference to the forest interests of the New England States. They were charged with the duty of memorializing the Governors and Legislatures of the States and to do all that is reasonably possible to secure a conservative forest policy which shall tend to mitigate the evils of forest fires and to encourage land owners to cultivate trees, with a view to maintain the vast resources of the lumber supply of the country. The following were appointed as members of the committee: Gen. Charles Hamlin, Bangor, and Hon. John E. Hobbs, North Berwick, for Maine; Mr. W. I. Ladd, Lancaster, and Mr. George B. Walker, of Concord, for New Hampshire; Mr. T. S. Gold, West Cornwall, and Hon. B. G. Northrop, Clinton, for Connecticut; Mr. W. C. Strong, Newton, and Mr. Francis H. Appleton, Boston, for Massachusetts; Mr. Henry G. Russell, West Greenwich, and Mr. Hathaway, for Rhode Island; Hon. Frederick Billings and Dr. Hiram Cutting, for Vermont.

The remainder of the forenoon was occupied with the reading of some brief papers and with statements in regard to the condition of forestry in various places. Major Phinney spoke of the successful planting of the pitch pine in Barnstable county, which had much enhanced the value of the land.

Mr. S. W. Powell, of Brooklyn, N. Y., read a paper on the requisites of an effective fire legislation, and Mr. E. B. Southwick, the botanist of the New York Central Park, exhibited a very interesting collection of specimens illustrating forestry. It occupied 50 cases, and consisted of nearly 500 specimens, embracing sections of wood, seeds, cones, acorns, wood fibres, fungi, galls, insect borings, cocoons, pith, bark, sawdust, and various other products of the woods.

On motion of Mr. Elizur Wright, the Legislative Committee was instructed to take into consideration the Middlesex Fells.

VOTES OF THANKS.

The usual vote of thanks was given to the reporters of the press, but in this case with more than the usual heartiness, for the reporters had given very full and accurate accounts of the meetings and of the papers read. Their work was spoken of by several members in connection with the passage of the vote of thanks. It was the manifest feeling of the Congress that they were greatly indebted to the Boston press for presenting the views of the Congress on forestal subjects to the public in such an appreciative and effective manner.

The thanks of the Congress were also given most heartily to the officers of the Massachusetts Horticultural Society for the use of their hall and for the courtesy and painstaking care with which they had made arrangements for the comfort and success of the Congress at its present meeting, and especially to Hon. Wm. C. Strong, chairman of the Committee of Arrangements, and to Mr. F. W. Brewer, of Hingham.

After a hearty vote of thanks to Governor Robinson and his Honor Mayor O'Brien the Congress adjourned to meet next year at such place as may be chosen by the Executive Committee.

But though the formal sessions of the Congress were now ended, much that was most enjoyable and of practical interest and utility in a forestry point of view yet remained for the members. In compliance with the invitation of the Mayor most of the members of the Congress and many of the ladies accompanying them took steamer at 2 o'clock in the afternoon for an excursion down the harbor and a visit to Deer Island, the site of the city's prison and reform school. The sail among the islands of the harbor was delightful and the visit to Deer Island was very interesting, giving all a favorable impression of the care and wisdom with which Boston watches over those who have been led to take the first steps in vice and seeks to reclaim them. Two hundred of the boys and girls were assembled in the neat chapel and welcomed the Congress with pleasant songs, accompanied by an organ and a band of instruments. After an inspection of the buildings an excellent collation was served, and the members of the Congress returned to the city about dusk.

EXCURSION TO WOOD'S HOLL.

The Forestry Congress, though a formal adjournment was made on Thursday, really continued its meeting through Friday by engaging in an excursion to Wood's Holl to inspect the forest of 200 acres which Mr. J. S. Fay, of this city, has grown there from seed planted at different times within the past twenty-five or thirty years. Not the least valuable of the sessions of the Congress were those held in the special car devoted to its use while on its way to Wood's Holl and back. The subjects which had been brought forward by the papers read in Horticultural Hall were discussed in a free way, while objects of interest in connection with forestry were constantly presented from the car windows. But the great meeting of the day was that at Wood's Holl. Mr. Fay was at the station on the arrival of the train, with a sufficient number of carriages to contain the members of the Congress, and two hours were spent in driving about the forest and hearing Mr. Fay's explanation of the method of his work. On as bare and wind-swept piece of ground as can be found, perhaps, along our coast and on poor soil, Mr. Fay began, years ago, to scatter over the trodden-down grass the seeds of our common yellow or pitch pine, and here to-day is a dense body of wood, in places almost impenetrable. Many of the trees are fifty or more feet in height. Having gained a foothold of pines, and thus raised a screen against the driving winds from the ocean, Mr. Fay planted behind them the seeds of other trees, evergreen and deciduous, and with unfailing success.

The members of the Congress were delighted to see this proof that forest trees can be so easily raised from seed under such unfavorable circumstances. It was a confirmation of what they had believed and taught, and nothing more convincing and encouraging could be asked for. Mr. Fay said, emphatically, that farming had not paid and would not pay in such a situation, but that raising of forests would.

After inspecting the forest the members of the Congress were invited into the house to partake of an excellent collation.

An invitation had been received from Professor Baird, in charge of the United States fish hatchery near by, to visit that establishment. The invitation was accepted, and the Congress spent an hour in looking over that interesting place and listening to Professor Baird's explanations of the work going on under his direction, after which, with hearty thanks given to Mr. Fay, who accompanied the members to the cars, they returned to the city at 7 o'clock, and then finally separated, and the Congress was closed.

MEMBERS OF THE CONGRESS.

Adams, Prof. Chas. Kendall	Ithaca, N. Y.
Alsop, J. W.	Middletown, Conn.
*Alvord, Wm.	San Francisco, Cal.
Anderson, Chas.	Kuttawa, Ky.
Appleton, Francis W.	Peabody, Mass.
Baker, F. P.	Topeka, Kans.
Baker, H.	Oneonta, N. Y.
Bicknell, J. W.	Boston, Mass.
*Billings, Fred.	Woodstock, Vt.
*Bishop, Heber R.	993 Fifth avenue, New York city.
Bock, S.	Dayton, Ohio.
Booth, J. R.	Ottawa, Ontario.
*Bowditch, J. H.	60 Devonshire street, Boston, Mass.
*Brewer, F. W.	Hingham, Mass.
*Brooks, Henry	Boston, Mass.
Bryant, J. H.	St. Paul, Minn.
Bryson, G. B.	Fort Caulonge, Quebec.
Buchanan, W. J.	Montreal, Canada.
Budd, Prof. J. L.	Ames, Iowa.
Burson, D. C.	Philadelphia, Pa.
Burnet, Robt.	Box 23, Burlington, Ontario.
Burrows, Acton	Winnipeg, Manitoba.
Butcher, B. L.	Wheeling, W. Va.
*Chase, Geo. B.	234 Beacon street, Boston, Mass.
Colman, N. J.	Washington, D. C.
Crombie, W. A.	Burlington, Vt.
Cullman, John G.	Cullman, Ala.
*Cutting, Dr. Hiram A.	Lunenburgh, Vt.
Dana, Geo.	Belpre, Ohio.
Daniels, Edw.	St. Paul, Minn.
*Davis, Sam. T.	Lakewood, N. J.
Dean, Harman	Sidney, Ohio.
*De Forrest, R. W.	120 Broadway, New York city.
*Doane, Thos.	Charlestown, Mass.
*Dolge, Alfr.	Dolgeville, N. Y.
*Drummond, A. T.	Montreal, Canada.
Egleston, N. H.	Washington, D. C.
Ellwanger, Geo.	Rochester, N. Y.
Emery, S. M.	Lake City, Mich.
Farley, Miss Sarah J.	Westchester, Chester county, Pa.
*Fay, Jas. S.	Wood's Holl, Mass.
*Fay, Miss Sarah B.	Pomfret Center, Conn.
Fell, Jesse W.	Normal, Ill.
*Fernow, B. E.	New York city.
*Fisher, Wm. Hubbell	Cincinnati, Ohio.
Flynt, W. N.	Monson, Mass.
Foster, Sam	Muscatine, Iowa.
*French, J. D. W.	Boston, Mass.
Furnas, Dr. A.	Danville, Ind.
Furnas, R. W.	Brownville, Nebraska.
Gamble, J. N.	Cincinnati, Ohio.
Gano, J. A.	Cincinnati, Ohio.
Gibbs, Jr., Oliver	Lake City, Minn.
Gilbert, A. W.	Ross, Ohio.
*Ginn, Edw.	Boston, Mass.
Gold, T. S.	West Cornwall, Conn.

*Life members.

Goodwin, Frank	Boston, Mass.
Grinnell, J. B.	Grinnell, Iowa.
Hathaway, Edw.	Otsdawa, N. Y.
Haines, J. S.	Germantown, Pa.
Heaver, Wm	Los Angeles, Cal.
Heneker, R. W.	Sherbrooke, Ont.
*Hicks, J. S.	Roslyn, L. I.
Hill, Dav.	Dundee, Ill.
*Higley, Warren	New York.
Hobbs, J. E	North Berwick, Me.
Hudson, Stephens	Lowville, N. Y.
Jackson, R. T.	89 Charles street, Boston, Mass.
*Jackson, Thos.	Portland, Me.
*Jessup, Morris K.	52 William street, New York city.
*Joly, H. G.	Pointe Platon, Quebec.
Knapp, J. G.	Limona, Florida.
*King, J. A.	Great Neck, L. I.
Ladd, W. S.	Lancaster, N. H.
Lazenby, W. R.	Columbus, Ohio.
Leue, Adolph	Cincinnati, Ohio.
Little, C. B.	Montreal, Canada.
Little, L. G.	Montreal, Canada.
*Little, Wm.	Montreal, Canada.
Loring, Geo. B.	Salem, Mass.
*Low, John	Chelsea, Mass.
*Low, H. R.	Middletown, N. Y.
Lyman, J. D.	Exeter, N. H.
Lynch, W. W.	Quebec.
McLaurin, John	East Templeton, Quebec.
Manning, J. W.	Reading, Mass.
*Mathieu, J. A.	Detroit, Mich.
*May, John Jay	Boston, Mass.
Minier, G. W.	Minier, Ill.
Mohr, Carl	Mobile, Ala.
Morgan, J. H.	Amherstburgh, Ontario.
Morse, Geo. H.	Burlington, Iowa.
*Morton, J. Sterling	Nebraska City, Nebr.
Myer, Chas. H. L.	Fond du Lac, Wis.
Northrop, B. G.	Clinton, Conn.
*Olmstead, Fred. Law	Brookline, Mass.
Parsons, C. J.	
Parsons, H. C.	Natural Bridge, W. Va.
Pearson, J. M.	Godfrey, Ill.
*Peabody, Chas. P.	Philadelphia, Pa.
Peffer, Geo. P.	Peewaukee, Wis.
*Pellew, Henry E.	New York.
*Peterson, P. S.	Chicago, Ill.
Poore, Ben: Perley	Newburyport, Mass.
Rathbone, Acors	Albany, N. Y.
Read, M. C.	Hudson, Ohio.
Riley, C. V.	Washington, D. C.
Robertson, D. R.	St. Paul, Minn.
Rock, John	San Jose, Cal.
Rollins, Wm. Herbert	Boston, Mass.
Ross, Wm. H.	Ross Mills, Quebec.
Russell, H. G.	Narragansett, R. I.
Saunders, Wm.	London, Ontario.
Savage, A. B.	St. Paul, Minn.
Scofield, L. K.	Freeport, Ill.
Seeley, H. M.	Middlebury, Vt.
Sewall, Jas. S.	St. Paul, Minn.
*Smith, Benj. J.	Cambridge, Mass.
Sohn, John W.	Hamilton, Ohio.
Southwick, E. B.	Central Park, New York.

* Life members.

Springer, Alf.	Cincinnati, Ohio.
Stephens, W. H.	Lowville, N. Y.
Stewart, J. T.	Peoria, Ill.
Strong, Wm. C.	Newton Highlands, Mass.
Tachee, E. E.	Ass't Commis. Crown Lands, Quebec.
Thane, E. S.	Ottawa, Ontario.
Thayer, Dr. W. A.	Cooperstown, N. Y.
Thistle, W. R.	Ottawa, Ontario.
Thomson, Lemon	Albany, N. Y.
Townsend, N. S.	Columbus, Ohio.
Underwood, J. M.	Lake City, Minn.
Vasey, Dr. Geo.	Washington, D. C.
Walker, Geo. B.	Concord, N. H.
Ward, J. K.	Montreal, Can.
Warder, R. B.	Lafayette, Ind.
*Warder, R. H.	North Bend, Ohio.
Ware, Horace E.	Milton, Mass.
*Waters, E. F.	Boston, Mass.
Watrous, C. L.	Des Moines, Iowa.
*Wheildan, Wm.	Concord, Mass.
Williams, J. F.	St. Paul, Minn.
Wilson, Horace	Columbus, Ohio.
*Wright, Elizur†	Boston, Mass.
Wright, Geo. H.	Sioux City, Iowa.
Young, H. H.	St. Paul, Minn.

* Life members. † Died November 20, '85.

CONTRIBUTORS TO PUBLICATION FUND.

Warren Higley	$20 00	J. J. May for two life memberships	$20 00
W. W. Wheildan	20 00	Jos. S. Fay	20 00
Ed. Ginn	20 00	J. S. Haines	2 00
Ed. Ginn, pledged	20 00	J. S. Hicks, pledged	60 00
J. Sterling Morton	20 00	Acton Burrow, subscription	1 00
Wm. Little	20 00	Alf. Dolge, subscription	1 00
J. J. May	20 00		

PROCEEDINGS

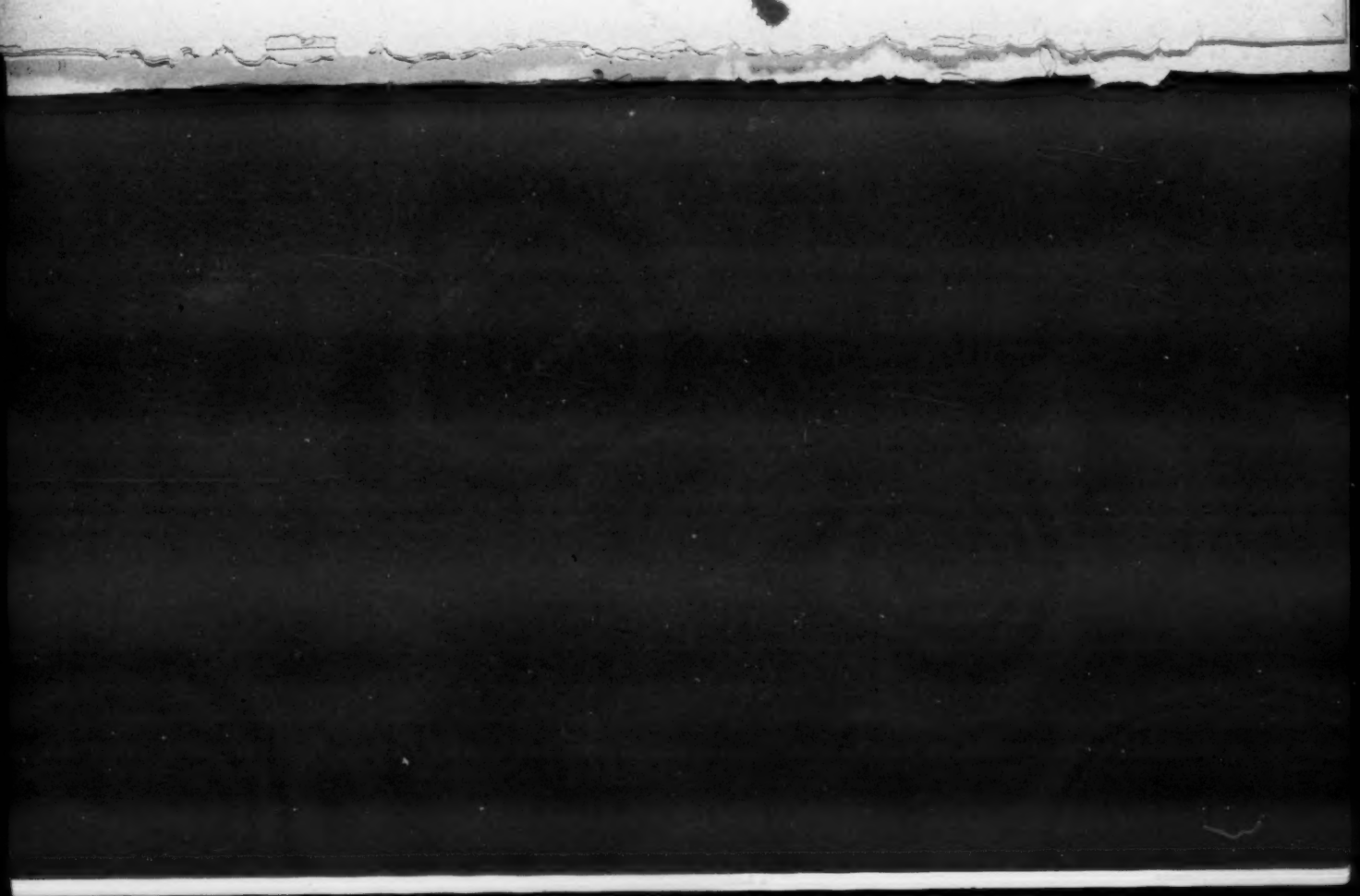
Postage 7¢

OF THE

AMERICAN FORESTRY CONGRESS

AT ITS MEETING HELD IN BOSTON, SEPTEMBER, 1885.

WASHINGTON:
JUDD & DETWEILER, PRINTERS.
1886.



PROCEEDINGS

OF THE

AMERICAN FORESTRY CONGRESS

AT ITS MEETING HELD IN BOSTON, SEPTEMBER, 1885.

WASHINGTON:
JUDD & DETWEILER, PRINTERS.
1886.

NOTE.—The American Forestry Congress, whether inviting persons to read papers from its platform or publishing those papers afterwards in connection with its proceedings, is not to be understood as endorsing the views expressed or adopting them as its own. The Congress offers its platform, in a liberal spirit, for the purpose of promoting a free and full discussion of all questions of importance connected with the subject of Forestry.

CONTENTS.

Page.

Officers iv

Members v

Constitution and By-Laws 2

Call for the Fourth Annual Meeting 4

PROCEEDINGS:

Address of President Higley 7

Report of Corresponding Secretary 14

Report of the Treasurer 16

Resolutions in regard to Dr. F. B. Hough 17

Address of Governor Robinson 18

PAPERS AND ADDRESSES:

Some Facts and Figures in respect to the Forests of the Country and their Consumption, with an accompanying diagram. By N. H. Egleston 25

Alarming Destruction of American Forests. By Wm. Little 26

Forest Preservation in Canada. By A. T. Drummond 36

Lumbering in Canada. By J. K. Ward 38

Lumber Interests—their dependence on Systematic Forestry. By John E. Hobbs 40

Arbor Day. By John B. Peaslee 48

Arbor Day. By J. Sterling Morton 49

Address of Hon. Geo. B. Loring 53

The State of Legislation in regard to Forests. By N. H. Egleston 58

What are the Essential Features of an Efficient Forest-fire Legislation. By S. W. Powell 63

Letter from H. C. Putnam 65

Smoke-consuming Devices for Locomotives. By J. N. Lauder 65

The Future of the Forests of the Lower Southern States and their Probable Timber Supplies. By Chas. Mohr 68

Reclamation of Waste Lands. By B. G. Northrop 72

Sea-coast Planting—its importance, practicability, and Methods. By William C. Strong 76

Transplanting Evergreen Trees. By William C. Strong 78

Culture of the Black Walnut in Northern Latitudes. By Hon. H. G. Joly 79

The Red Cedar and Osier Willow. By Edmund Hersey 80

Some Practical Hints on Tree-raising. By Joseph S. Fay 83

Pruning the Forest. By B. E. Fernow 84

Lumberman's Waste as a Fertilizer. By B. E. Fernow 89

Forest Entomology. By E. B. Southwick 91

Relation of Forests to Floods. By Thos. P. Roberts 92

Tables accompanying Mr. Roberts' paper 103

Advertisements 107

OFFICERS.

President, Hon. WARREN HIGLEY, New York city.
First Vice-President, Hon. H. G. JOLY, Quebec.
Second Vice-President, Hon. J. STERLING MORTON, Nebraska City, Neb.
Recording Secretary, N. H. EGLESTON, Dept. of Agriculture, Washington, D. C.
Corresponding Secretary, B. E. FERNOW, Dept. of Agriculture, Washington, D. C.
Treasurer, JOHN S. HICKS, Roslyn, Long Island.

EXECUTIVE COMMITTEE.

This committee consists of the above regular officers, together with—
Hon. B. G. NORTHROP, Cinton, Conn.
Hon. WILLIAM LITTLE, Montreal, Canada.
Hon. J. B. GRINNELL, Grinnell, Iowa.
Hon. J. G. KNAPP, Limona, Florida.
R. H. WARDER, Esq., North Bend, Ohio.

STANDING COMMITTEES FOR 1885–'6.

On New England Forest Policy: Gen. CHAS. HAMLIN and JOHN E. HOBBS, of Maine; WM. S. LADD and GEO. B. WALKER, of New Hampshire; FRANCIS H. APPLETON and WM. C. STRONG, of Massachusetts; HENRY G. RUSSELL and CHAS. W. SMITH, of Rhode Island; T. S. GOLD and B. G. NORTHROP, of Connecticut; REDFIELD PROCTOR and HIRAM CUTTING, of Vermont.

On Legislation: Ex-Gov. J. STERLING MORTON, of Nebraska; N. H. EGLESTON, of Washington, D. C.; Hon. T. S. GOLD, of Connecticut; Hon. H. R. LOW, of New York; Hon. J. B. GRINNELL, of Iowa.

On Arbor Day: Hon. B. G. NORTHROP, of Connecticut; N. H. EGLESTON, of Washington, D. C.; Hon. J. B. PEASLEE, of Ohio.

On Publication: N. H. EGLESTON, of Washington, D. C.; F. W. BREWER, of Hingham, Mass.; B. E. FERNOW, of New York city.

MEMBERS OF THE CONGRESS.

Adams, Prof. Chas. Kendall.....Ithaca, N. Y
Alsop, J. W. .....Middletown, Conn.
* Alvord, Hon. Wm.....San Francisco, Cal.
Anderson, Chas.....Kuttawa, Ky.
Appleton, Prof. Francis H.....Peabody, Mass.
Baker, F. P.....Topeka, Kans.
Baker, Harvey.....Oneonta, N. Y.
Bicknell, J. W.....Boston, Mass.
* Billings, Hon. Fred. .....Woodstock, Vt.
* Bishop, Heber R. .....993 Fifth avenue, New York city.
Bock, S.....Dayton, Ohio.
Booth, J. R.....Ottawa, Ontario.
* Bowditch, J. H. .....60 Devonshire street, Boston, Mass.
* Brewer, F. W. .....Hingham, Mass.
* Brooks, Henry .....Boston, Mass.
Bryant, J. H.....St. Paul, Minn.
Bryson, G. B.....Fort Caulonge, Quebec.
Buchanan, W. J.....Montreal, Canada.
Budd, Prof. J. L. .....Ames, Iowa.
Burson, D. C.....Topeka, Kans.
Burnet, Robt. .....Box 23, Burlington, Ontario.
Burrows, Acton .....Winnipeg, Manitoba.
Butcher, B. L. .....Wheeling, W. Va.
* Chase, Geo. B.....234 Beacon street, Boston, Mass.
Colman, N. J. .....Washington, D. C., Comm'r of Agriculture.
Crombie, W. A.....Burlington, Vt.
Cullman, John G. .....Cullman, Ala.
* Cutting, Dr. Hiram A.....Lunenburgh, Vt.
Dana, Geo. .....Belpre, Ohio.
Daniels, Edw. .....St. Paul, Minn.
* Davis, Sam. T. .....Lakewood, N. J.
Dean, Harman .....Sidney, Ohio.
* De Forrest, R. W. .....120 Broadway, New York city.
* Doane, Thos. .....Charlestown, Mass.
* Dolge, Alfr. .....Dolgeville, N. Y.
* Drummond, A. T. .....Montreal, Canada.
Egleston, N. H.....Washington, D. C., Division of Forestry.
Ellwanger, Geo.....Rochester, N. Y.
Emery, S. M. .....Lake City, Mich.
Farley, Miss Sarah J. .....Westchester, Chester county, Pa.
* Fay, Joseph S. .....Boston and Wood's Holl, Mass.
* Fay, Miss Sarah B. .....Pomfret Center, Conn.
Fell, Jesse W. .....Normal, Ill.
* Fernow, B. E. .....Washington, D. C., Chief Division of Forestry.
* Fisher, Wm. Hubbell .....Cincinnati, Ohio.
Flynt, W, N. .....Monson, Mass.
Foster, Sam.....Muscatine, Iowa.
* French, J. D. W.....Boston, Mass.
Furnas, Dr. A.....Danville, Ind.
Furnas, R. W.....Brownville, Nebraska.
Gamble, J. N. .....Cincinnati, Ohio.
Gano, J. A.....Cincinnati, Ohio.
Gibbs, Jr., Oliver .....Lake City, Minn.
Gilbert, A. W. .....Ross, Ohio.
* Ginn, Edw.....Boston, Mass.

* Life members.

Gold, T. S. ---------- West Cornwall, Conn., Sec. Bd. of Agriculture.
Goodwin, Frank ---------- Boston, Mass.
Grinnell, Hon. J. B. ---------- Grinnell, Iowa.
Hathaway, Edw. ---------- Otsdawa, N. Y.
Haines, J. S. ---------- Germantown, Pa.
Heaver, Wm. ---------- Los Angeles, Cal.
Heneker, R. W. ---------- Sherbrooke, Ont.
*Hicks, J. S. ---------- Roslyn, L. I.
Hill, Dav. ---------- Dundee, Ill.
*Higley, Hon. Warren ---------- Potter building, New York.
Hobbs, J. E. ---------- North Berwick, Me.
Hudson, Stephens ---------- Lowville, N. Y
Jackson, R. T. ---------- 89 Charles street, Boston, Mass.
*Jackson, Thos. ---------- Portland, Me.
*Jessup, Morris K. ---------- 52 William street, New York city.
*Joly, Hon. H. G. ---------- Pointe Platon, Quebec.
Knapp, J. G. ---------- Limona, Florida.
*King, J. A. ---------- Great Neck, L. I.
Ladd, W. S. ---------- Lancaster, N. H.
Lazenby, W. R. ---------- Columbus, Ohio.
Leue, Adolph ---------- Cincinnati, Ohio.
Little, C. B. ---------- Montreal, Canada.
Little, L. G. ---------- Montreal, Canada.
*Little, Hon. Wm. ---------- Montreal, Canada.
Loring, Hon. Geo. B. ---------- Salem, Mass., late U. S. Comm'r of Agriculture.
*Low, John ---------- Chelsea, Mass.
*Low, Hon. H. R. ---------- Middletown, N. Y.
Lyman, J. D. ---------- Exeter, N. H.
Lynch, W. W. ---------- Quebec.
McLaurin, John ---------- East Templeton, Quebec.
Manning, J. W. ---------- Reading, Mass.
*Mathieu, J. A. ---------- Detroit, Mich.
*May, John Jay ---------- Boston, Mass.
Minier, G. W. ---------- Minier, Ill.
Mohr, Carl ---------- Mobile, Ala.
Morgan, J. H. ---------- Amherstburgh, Ontario.
Morse, Geo. H. ---------- Burlington, Iowa.
*Morton, Hon. J. Sterling ---------- Nebraska City, Nebr.
Myer, Chas. H. L. ---------- Fond du Lac, Wis.
Northrop, Hon. B. G. ---------- Clinton, Conn.
*Olmstead, Fred. Law ---------- Brookline, Mass.
Parsons, C. J. ---------- Brooklyn, N. Y.
Parsons, H. C. ---------- Natural Bridge, W. Va.
Pearson, J. M. ---------- Godfrey, Ill.
*Peabody, Chas. P. ---------- Philadelphia, Pa.
Peffer, Geo. P. ---------- Peewaukee, Wis.
*Pellew, Henry E. ---------- New York.
*Peterson, P. S. ---------- Chicago, Ill.
Poore, Ben: Perley ---------- Newburyport, Mass.
Rathbone, Acors ---------- Albany, N. Y.
Read, M. C. ---------- Hudson, Ohio.
Riley, Prof. C. V. ---------- Washington, D. C., Entomologist U. S. Ag Dep.
Robertson, D. R. ---------- St. Paul, Minn.
Rock, John ---------- San Jose, Cal.
Rollins, Wm. Herbert, M. D. ---------- Boston, Mass.
Ross, Wm. H. ---------- Ross Mills, Quebec.
Russell, H. G. ---------- Narragansett, R. I.
Saunders, Prof. Wm. ---------- London, Ontario.
Savage, A. B. ---------- St. Paul, Minn.
Scofield, L. K. ---------- Freeport, Ill.
Seeley, H. M. ---------- Middlebury, Vt.
Sewall, Jas. S. ---------- St. Paul, Minn.
*Smith, Benj. G. ---------- Cambridge, Mass.
Sohn, John W. ---------- Hamilton, Ohio.
Southwick, E. B. ---------- Central Park, New York.

---

*Life members.

Springer, Alfred	Cincinnati, Ohio.
Stephens, W. H.	Lowville, N. Y.
Stewart, J. T.	Peoria, Ill.
Strong, Wm. C.	Newton Highlands, Mass.
Tachee, E. E.	Ass't Commissioner Crown Lands, Quebec.
Thane, E. S.	Ottawa, Ontario.
Thayer, Dr. W. A.	Cooperstown, N. Y.
Thistle, W. R.	Ottawa, Ontario.
Thomson, Lemon	Albany, N. Y.
Townsend, N. S.	Columbus, Ohio.
Underwood, J. M.	Lake City, Minn.
Vasey, Dr. Geo.	Washington, D. C., Botanist, U. S. Dep't of Agric.
Walker, Joseph B.	Concord, N. H.
Ward, J. K.	Montreal, Can.
Warder, R. B.	Lafayette, Ind.
*Warder, R. H.	North Bend, Ohio.
Ware, Horace E.	Milton, Mass.
*Waters, E. F.	Boston, Mass.
Watrous, C. L.	Des Moines, Iowa.
*Wheildon, Wm. W.	Concord, Mass.
Williams, J. F.	St. Paul, Minn.
Wilson, Horace	Columbus, Ohio.
Wright, Geo. H.	Sioux City, Iowa.
Young, H. H.	St. Paul, Minn.

*Life members.

CONTRIBUTORS TO PUBLICATION FUND.

Acton Burrows	$1 00
Alf. Dolge	1 00
Jos. S. Fay	20 00
Ed. Ginn	20 00
Ed. Ginn, pledged	20 00
J. S. Haines	2 00
J. S. Hicks	60 00
Warren Higley	20 00
Wm. Little	20 00
J. J. May	20 00
J. J. May, for two life memberships	20 00
J. Sterling Morton	20 00
Wm. W. Wheildon	20 00

CONSTITUTION AND BY-LAWS

OF THE

AMERICAN FORESTRY CONGRESS.

ARTICLE I. This Association shall be known as the American Forestry Congress.

ARTICLE II. The objects of this Congress shall be the discussion of subjects relating to tree-planting; the conservation, management, and renewal of forests; the climatic and other influences that affect their welfare; the collection of forest statistics, and the advancement of educational, legislative, or other measures tending to the promotion of these objects. It shall specially endeavor to centralize the work done and diffuse the knowledge gained.

ARTICLE III. Any person may be elected a member of this Congress upon the recommendation of two members and the payment of two dollars. The annual dues shall be two dollars.

ARTICLE IV. The officers of this Congress, to be elected at the annual meeting, are as follows: President, First Vice-President, Second Vice-President, Recording Secretary, Corresponding Secretary, Treasurer, and an Executive Committee, consisting of these officers and five members in addition.

ARTICLE V. The President shall preside at all meetings of the Congress in General Session, and deliver an annual address at the close of his term.

ARTICLE VI. The President, Vice-Presidents, Secretaries, Treasurer, and five other persons to be chosen annually, shall constitute an Executive Committee for the transaction of such business as may be required by this Constitution or by a vote of the Congress.

ARTICLE VII. The Recording Secretary shall keep a record of the proceedings of the Congress, and shall be custodian of all documents, books, and collections ordered to preserved.

ARTICLE VIII. The Corresponding Secretary shall conduct the correspondence of the Congress.

ARTICLE IX. The Treasurer shall have charge of all funds, and pay out the same on the direction of the Executive Committee.

ARTICLE X. The Congress at any regular meeting, or its Executive Committee, in the intervals between its meetings, may appoint such local or special committees as may be deemed proper, and shall define their duties.

ARTICLE XI. The annual meeting of the Congress shall be in the month of August or September, or at such times and places as shall be determined by a vote in General Session.

ARTICLE XII. At each annual meeting there shall be an election of officers for the ensuing year, and they shall remain in office until others are chosen. In cases of vacancies occurring in the intervals between the annual meetings they may be filled by the Executive Committee until others are selected. In case of absence of an officer at a regular meeting his place may be deemed vacant.

ARTICLE XIII. The officers of States, Territories, Provinces, or Local Forestry Associations, or their delegates, or the delegates of any Government, may participate in the proceedings of the Congress as Honorary Members.

ARTICLE XIV. This Constitution may be amended by a two-thirds vote of the members present at any annual meeting.

BY-LAWS.

1. Papers or abstracts of papers to be read must be sent two weeks before any meeting, for classification, to the Corresponding Secretary.

2. The following classification of subjects is adopted for the reading of papers:

Section A. Forest Planting, Forest Management, Forestry Proper, Preservation of Forests.

Section B. Forest Economy, Technology, and Statistics.

Section C. Applied Science and Climatology, General Topics.

3. Contributors who are present shall have the preference in reading their papers.

4. Any member shall be entitled to the privilege of using any books or documents, not of record, at the discretion of the Recording Secretary.

CALL FOR THE FOURTH ANNUAL MEETING, BOSTON, MASS.

We earnestly appeal to all patriotic citizens to join us in the endeavor to arouse public sentiment to the necessity of reform in the utilization of our timber supply and the treatment of our forest lands.

We are actuated by the following considerations:

1. The general and local climatological influence of forest areas, though not yet clearly defined and numerically demonstrated, is beyond doubt established by historical and experimental evidence.

2. The effect of wholesale clearing of forest-clad hills and mountains on the amount and distribution of meteoric precipitations, though not the only cause of waning or irregular water supply, is undoubtedly the principal one, and admits of no doubt.

3. The immediate benefit to agricultural interests derived from properly-distributed forest areas is understood by every intelligent farmer.

4. The natural source of a yearly product of seven hundred million dollars, which the forests at present represent, deserves careful husbanding with a view to its continuity, and calls for due consideration of its interests by legislators as well as by the people at large. Without joining in the cries of alarmists, we have good reasons and sufficient data to assert that the present policy, if continued, must seriously affect this factor of national wealth at no distant time.

5. The excuse of the first settlers in regardlessly removing the forest has no more existence. Wastefulness in the methods of lumbering, as in the reckless destruction by fires—the loss from this cause amounting to more than ten million acres, or value of twenty-five million dollars in one year—with regard to forest products and forest lands, has become criminal, in view of the far-reaching influences which the forests exert.

WHAT WE PROPOSE TO DO.

To effect a reform in this line of economics, in which task we most heartily invite you to co-operate with us, we advocate the following action:

1. To bring the facts which form the basis of the foregoing considerations before the public in an unequivocal manner.

2. To encourage further research and instruction in forestry matters by the establishment of experiment stations, the introduction of lectures or courses on forestry in schools and colleges, the assiduous employment of the press in disseminating correct practical information.

3. To promote and assist the formation of Local Associations for the purpose of furthering the true interests of forestry in every State, teaching and encouraging a systematic use of her forests, and imbuing her citizens with a recognition of their importance.

4. To urge the Legislatures of the different States to enact and enable the enforcement of effective laws for the prevention of fires.

5. To urge the National Government to the enforcement of a sound policy as to its own lands, treating the eighty-five million acres of public forest property as a valuable national treasure, instead of allowing its waste by depredators and fires.

6. To harmonize the interests of the lumberman and the forester,

and devise for the lumbering interest such protection as is *not given at the cost of the forest.*

7. To create popular sentiment against waste, and a love and incentive for Arboriculture by the institution of Arbor-days, by favors to tree-planters in the form of premiums, bounties, or exemption from taxes.

What has been done so far to advance the interest of our cause, in many cases traceable, directly or indirectly, to the influence and work of this Congress, can be shortly recited, as follows:

1. Forestry Associations have been formed in Minnesota, Ohio, Canada, Manitoba, Colorado, New York, while Horticultural and Agricultural Societies have been led to give a prominent place in their discussions to the subject of forestry.

2. Forestry Commissions or Commissioners, either to inquire into the needs of or to manage the forest domain of their States, have been appointed in Vermont, New Hampshire, New York, Pennsylvania, Ohio, Colorado, California.

3. Arbor-days have been instituted in fifteen States of the Union and in the Canadas. Under this incentive in Nebraska, where this observance originated, more than five million trees were planted the past year.

4. The effective fire-legislation now prevailing in Canada was enacted directly upon the specific recommendation of this Congress.

5. The Congress of the United States, largely through the influence of our efforts, has under serious consideration most important legislation with reference to the forests of our national domain.

6. The Forestry Bureau, as a branch of the Agricultural Department at Washington, has collected valuable material in furtherance of the knowledge of our forest condition, in addition to Prof. C. S. Sargent's invaluable work of the census of 1880.

7. Whilst the publications of a "Journal of Forestry," "Forestry Bulletins," "Forestry Manuals," "Forestry Reports," have tried to furnish the needed special information, the press throughout the country, in all its branches, has done good work in creating a widespread interest and a growing readiness for action.

Yet whilst the need of a change of policy is admitted, the means for accomplishing that change are still inadequate. Specific aims and methods yet remain undetermined.

Here is a great problem of national economy worthy the thought and active aid of the best men of the nation!

Here is a duty for every thinking and well-meaning citizen to help preserve and hand over to our children, in full productive power, one of our richest natural resources; nay, the most potent factor of national prosperity!

Here is the opportunity to exercise that duty, in joining those who have begun to open the road to reform!

Change of public sentiment is needed, and such a change can only be effected by the united effort of the best elements.

We need the strongest utterances of the most influential men. We desire the co-operation of every good citizen in the unselfish work which we have undertaken.

You are cordially invited to meet with us.

PROCEEDINGS OF THE FOURTH ANNUAL MEETING

OF THE

AMERICAN FORESTRY CONGRESS.

The fourth annual meeting of the American Forestry Congress was held at Boston, Mass., September 22, 23, and 24, 1885. The meeting was one of great interest, and very encouraging to the members. One of the local papers heralded the approaching assembly in the following words:

It is not long since America was a forest without any congress. For a little more than a hundred years it has had a congress, and now it has too little forest. People are rapidly increasing, and trees are decreasing more rapidly. It is by no means true that there is not room for trees to increase as fast as the people do. The hills and mountains make it sure that there always will be. But they will soon be bare of trees—have nothing to cover them from the burning sun but scrub. If the people do not plant trees, and the right kind of trees, to grow on them, there is a possible desert in the future, with neither men nor trees on it, where population is now most abundant. A few thinking men and women, scattered all over North America, including the United States and Canada, have come to a realizing sense of this serious state of facts, and elected themselves into a Congress to look after the health and prosperity of the trees, which they correctly regard as the indispensable friends of men and animals. This Congress of scientific people from every part of Canada and about every State in this Union will meet at the invitation of the Massachusetts Horticultural Society, and hold sessions in Horticultural Hall September 22, 23, and 24, which will be freely open to the public.

Massachusetts and our own dear over-crowded Boston will give this Congress the warmest possible welcome. It comes here because it is delighted to know that in 1882 the Legislature of this Commonwealth put on its statute-book a wise and well-considered general forestry law, constituting the Board of Agriculture a board of forestry, and authorizing the people of every town to devote land suitable to the purpose to be cared for as a public forest by that board. Under that law it is quite possible for the people of Boston to have, within half an hour's ride in a steam or horse car the use of a public domain of 4,000 acres, covered with every variety of trees and commanding broad views of both salt and fresh water. If the people lend their ears to what this Congress has to say the thing is done.

The sessions of the Congress were held in Horticultural Hall. No place could have been more pleasant or better adapted to the use of the Congress. The Horticultural Society, so long and favorably known among similar societies and to the whole country by its record, had generously placed its hall at the disposal of the Congress, and had also kindly assumed the office of a committee of arrangements for the occasion. Beautiful plants and small evergreen trees in boxes stood along the stairway leading to the assembly room, and seemed themselves to give a very appropriate welcome to the Congress of Forestry men. In the hall itself long tables were spread, which were covered with specimens of forest products, some in their natural state and others manufactured, showing the beauty of many of our woods and their adaptation to decorative purposes.

Although the meeting of the Congress was held in the extreme eastern part of the country, there was a very good attendance, not only of the members resident in the vicinity, but of others from a great distance. California and Nebraska were represented, as well as Canada and the nearer States. Several of the States sent delegations

to the Congress, and the General Government was represented in the person of Commissioner Coleman of the Department of Agriculture.

Earnestness and enthusiasm characterized the meeting throughout its sessions. A looker on must have felt that the members were full of interest in the subject which they had in hand, and which had convened them at this time. The three days of the meeting were fully occupied with the reading of papers and the discussion of them, and some valuable papers which had been prepared for the occasion for lack of time could only be read by their title.

Promptly at the designated time President Higley called the Congress to order and introduced His Honor Mayor O'Brien, who welcomed the Congress to Boston very cordially, and expressed his pleasure in meeting its members. He expressed the hope also that the assembling of the Congress in Boston would have the effect of creating in its citizens an enthusiasm in behalf of forestry which would lead them not only to secure all needful planting of trees along the highways, but the carrying out of the plan for the preservation of the Middlesex Fells, a project which our friend, Mr. Elizur Wright, has so much at heart. The Mayor alluded to the progress which had been made in Boston in the course of the last ten years in securing the ground for several public parks, which, he said, in a few years more would make the city one of the most beautiful in America. His Honor closed by repeating his welcome of the Congress to the city, and expressing the hope that the body might find time to visit some of the public institutions.

President Higley responded to the welcome of His Honor the Mayor, and at the same time acknowledged the obligations of the Congress to the Agricultural and Horticultural Societies of Boston and vicinity for the interest which they had manifested in the work of the Congress by providing Horticultural Hall as its place of meeting, and in various ways providing for its success. The President then made his annual address to the Congress as follows:

ADDRESS OF PRESIDENT HIGLEY.

The subject that brings us together on this occasion from various sections of the United States and Canada has within the past few years grown to be recognized by the leaders of public opinion in America and thinking men and women generally as one of the greatest importance to the public welfare. The discussions of topics relating to forestry and the timber supply, in farmers' clubs, lumbermen's conventions, horticultural and agricultural societies, associations of scientists, and more than all in the meetings of the American Forestry Congress, and in local forestry associations, have awakened a deep and widespread interest in the subject, that in some sections has found expression in important action, and throughout America has laid the foundation, I believe, through the conviction of public opinion, for the sure and onward progress of our cause. Its principles are bound to grow and strengthen until an American system of forestry, adapted to the conditions of the new world, shall be established and shall prevail in all the essentials of successful working, because necessity will compel it sooner or later. Of such vital importance to the people of the United States and Canada is the subject of cultivating and preserving the forests that it must soon command the serious attention of the National and State governments.

Something, to be sure, has been done by way of legislation; a small start has been made through the efforts of a few thoughtful and patriotic men. But before such practical results can be obtained as we desire, the importance of forest preservation and forestry administration must become apparent to the majority of the people. This can be done only through public discussion, wise agitation, educating. Facts of history and personal experience are abundant and convincing as to the effects of deforesting and again of reforesting large areas, upon the climate, the springs and streams, the fertility of soil, the various industries, and the general prosperity.

CHINA.

With such a system of timber culture as Prussia possesses—perhaps the best in the world—China would have escaped those horrible famines which have in the past attacked some of her most densely populated districts and caused the destruction of

millions of people, and imposed untold sufferings upon millions more, as well as the loss of a vast amount of treasure to the state. Only last month came the news from Canton of a great flood, the most serious in thirty years. "More than ten thousand persons lost their lives," says the report, "and a far greater number are left in a starving condition. Entire villages were engulfed, and the rice and silk crops were almost ruined." These destructive floods are largely due to the absence of forests which were long ago cut away from the mountain slopes and the headwaters of streams to give place to the food crop for the support of her dense population. The natural office of the forests in securing moisture and productiveness to the country around was supplied by an extensive system of irrigation and fertilization. Vegetables form the staple of food in China, and this explains how it is that 400,000,000 people can exist in a country only four or five times larger than France. We are told that Chinese horticulture embraces *eighty* different kinds of vegetables, of which *twenty-five*, at least, constitute valuable articles of food for man. The most important of these is rice, for the cultivation of which the Chinese spare no labor or expense. To aid in the cultivation of this cereal they have stripped whole provinces of their original forests, dug immense lakes, and even tunneled lofty mountains. For its sake they collect the waters of both stream and river and direct its course from the mountain's foot over the soil they wish to irrigate. Agriculture to the Chinaman is almost a religion. He repeats to himself the words of the Persian law:

"Be thou just to the plant, to the bull, and to the horse; nor be thou unmindful of the dog. The earth has a right to be sown: neglect it and it will curse thee; fertilize it and it will be grateful to thee. It says to him who tills it from the right to the left, and from the left to the right, may thy fields bring forth of all that is good to eat, and may thy countless villages abound with prosperity."

Ceres, who at Thebes and at Athens brought men together and made the laws, was considered but the reflecting mind of men who till the soil.

CENTRAL NEW YORK.

There is abundant evidence in America of the effects of cutting off the forests. In Central New York streams that thirty or forty years ago kept the ponds well filled for the saw-mill and grist-mill, and furnished a never-failing supply of running water for the farm, are now dry in summer, with the exception of here and there a stagnant pool; the dam is decayed and washed away, the mills gone, and the once picturesque scene is changed to that of desolation. Yet, with the warm rains of spring and the melting snows, the streams overflow their banks, the swift waters carry away fences, bridges, and embankments. Spring opens later. The young cattle were wont to be turned into the wood-sheltered pasture about the first of April; now they are kept shut up until the middle of May. Peach orchards that were sure to be loaded every year with luscious fruit have almost disappeared, and the crop is the exception rather than the rule. The extremes of heat and cold are greater, and droughts in summer and floods in springtime are more frequent and more destructive. Trace the stream from its source and the cause of these things is apparent. The old tamarack swamp that used to supply the boys and girls with aromatic gum, and in which the creek had its source, has all been cut away. The thickly wooded black-ash swamps, through which the stream ran in its course to the lake, have been cleared, and their marshy areas have given place to cultivated fields and pastures. The cutting away the forests from the headwaters and the banks of this stream accounts for the changes I have noted, and this picture, I doubt not, is a very familiar one in the New England and Middle States. It is not difficult for men who know the effects of cutting the timber from small areas around the headwaters of the smaller streams to understand why summer navigation in the Mississippi, the Missouri, and the Ohio has become difficult and at times impossible where it was easy and constant a few years ago; or why the Hudson and the Connecticut are much lower in summer and higher in spring than in former years. The partial deforesting of the Adirondack region has materially affected the flow of of the Hudson, the Mohawk, the Black, and other rivers, and sufficiently demonstrated the fact that were this great watershed of New York stripped of its forest covering, the Empire State would lose her prestige and New York city her rank as the first commercial city of the New World.

THE SCHUYLKILL.

For two years past the engineers of the water-works department of Philadelphia have been making examinations of all possible sources of a suitable water supply for their city, and have lately discovered how seriously the Schuylkill, from which the water supply is now taken, has been affected by the destruction of forests around its

headwaters. Sixty years ago the Schuylkill's summer flow was estimated at 500,000,000 gallons a day. Measurements made from time to time showed a gradual diminution, until in 1874 the minimum flow was only 250,000,000 gallons per day. This is a well authenticated fact, and it is shown that the diminution has been caused by cutting the forests from the headwaters of the supplying streams.

THE FRENCH ALPS.

In 1844 the eminent political economist, M. Blanqui, after visiting the provinces embracing the French Alps, once densely populated and prosperous in agriculture and grazing, presented to the academy a detailed memoir of his journey and observations, and, among other things, said:

"The Alps of Provence present a terrible aspect. In the more equable climate of northern France one can form no conception of those parched mountain gorges where not even a bush can be found to shelter a bird, where, at most, the wanderer sees in summer here and there a withered lavender, where all the springs were dried up, and where a dead silence, hardly broken by the hum of an insect, prevails. But if a storm bursts forth, masses of water suddenly shoot from the mountain heights into the shattered gulfs, waste without irrigating, deluge without refreshing the soil they overflow in their swift descent, and leave it even more scarred than it was from want of moisture. Man at last retires from the fearful desert, and I have the present season found not a living soul in districts where I remember to have enjoyed hospitality thirty years ago."

Such warnings of history are abundant. It is unnecessary to multiply them here. They are familiar to you from their frequent repetition. And yet it is time the people of America learn the sad history of suffering and desolation that have followed the destruction of the forests in the earlier-settled portions of the earth—in China and India, in Persia and Greece, in Switzerland, in portions of France and Italy, on the Istrian coasts of the Adriatic and the extensive shores of the Mediterranean, in Spain and in Palestine, whose rich fields, when her rugged hills and mountain sides were crowned with the sacred cedar, "flowed with milk and honey;" in classic Sicily, once the granary of Rome, and in many of the most beautiful islands of the sea—that they may heed the warning, study the forest conditions, and take the necessary steps to prevent the useless destruction now going on, and thereby escape the fate of those nations and communities that have in the past so recklessly made the unfortunate experiment of stripping the forests from valley and hill and mountain. From the history of these things, and the known data established by long-continued investigation and repeated experiment, we are justified in asserting:

1. That the forest areas exercise a positive climatic influence upon the surrounding country. They modify the extremes of heat and cold, and render the temperature more equable throughout the year.

2. That the deforesting of large areas of hilly and mountainous country affects to a very large extent the quantity of water that comes from springs and flows in rivers. The more apparent is this when the deforesting occurs on the headwaters of important streams. Then the water-power is destroyed or greatly impaired, navigation impeded, commerce interfered with, and droughts and floods are more frequent and more severe.

3. That the interests of agriculture and horticulture are greatly subserved by the proper distribution of forest areas through their climatic and hydrographic influence.

4. That a country, embracing within its borders the headwaters of all the streams and rivers that interlace it, when stripped of its forest covering, becomes a barren waste, incapable of supporting man or beast.

These general facts have been determined beyond question. But it remains for the people of every State and district to decide upon the necessary area and distribution of forest trees for each general locality, and the details incident to their planting, care, and preservation.

PROFITS IN FORESTRY.

The people naturally live and calculate for the present, and are disposed to use the property belonging to themselves so as to derive from it the greatest present good. For the good of neighbors, or the future welfare of the State, they will hardly be induced to forego the advantages to be derived from the cutting of timber and the drainage of swamps, though they knew that such cutting and drainage will eventually result in disaster to the country around; nor would it be fair and equitable for the individual to suffer in his estate for the advantage that might accrue to others, either in this or in future generations. The burden of sacrifice for the public good should be borne by all alike. But the true interests of forestry makes no such demand. On

the contrary, we claim that a wise management of the forest areas connected with the farmers' estates, and the maintenance of a due proportion of them through devoting to forestry purposes the now waste places of the farm, insure to the owner excellent returns for his labor and for the capital invested—a profit that compares favorably with that derived from the ploughed field. This becomes apparent when a fair money value is placed on all the wood and forest product used in many ways on the farm, as well as the timber that is cut for market. The timbered lot is not the dead property that it is often considered to be, and it is worthy the farmer's intelligent care and protection as a source of income.

Until this question is answered affirmatively and demonstrated satisfactorily, Americans will be slow to engage in tree planting for business purposes. Actuated by a sentiment for the beautiful, they will plant trees and adorn the landscape, and even preserve the forest, but not with a view to realize a profit thereby. Until settlements were pushed out into the treeless plains of the West, the necessity for forestry products on the farm had hardly been realized in this country, but then, through the want of them, their full value and countless blessings became apparent to the Kansas and Nebraska emigrant and the dwellers on the prairies of the West. They soon found it profitable to plant and care for trees. Twenty-five years ago cord-wood sold in some of the towns of Kansas and Nebraska for seven, eight, and sometimes ten dollars a cord, where it can now be purchased for from three to four dollars per cord, and that, too, with a population many times greater. "The reason for this," says ex-Governor Morton, "is simply from the fact that the natural groves have been protected from fire, and the artificial groves are turning out an abundance of good wood, such as the necessities of the country demand for fuel." The cultivation of forest trees in the prairie States has proved profitable, according to the testimony of those who have engaged in it. J. W. Davidson, in an article on "Timber Growing in Nebraska," says: "I estimate the cost of preparing an acre, and getting the cuttings of soft maple and ash (they can be had by the thousands along our streams), at $3 per acre. A man can plant 2½ acres per day. That is all the cost for ten years, except interest and taxes on land. I have 1,261 trees per acre. Seven years from planting I will cut one-fourth, or 340 trees, equal to 15 cords of wood; the eighth year 15 cords more; the ninth the same; the tenth year you see my profits. I should cut what is left, 456 trees. Allow four trees to the cord, so as not to overestimate it. I have several trees only ten years old which are 14 inches in diameter and 50 feet high. Four, I think, would make a cord. Allowing six trees to the cord, we have 76 cords, and with 45 cords cut before, 121 cords. At $3 per cord, allowing $1 for cutting, I have $242. As a source of profit, the raising of trees in Nebraska ranks next to the raising of stock."

Many experiments of forest culture have been made in New York and in the New England States with satisfactory results. The financial success of forest culture as a business must depend upon the cost of the land, the adaptability of the trees to the soil and climate, and the marketable value of the wood and timber when grown. While it may be profitable to grow forests in those sections of the country where wood and timber are scarce and high in price, it would be very far from profitable or desirable to plant in sections where lands covered with virgin forests of the most valuable timber can be bought for from $1 to $5 per acre, as they can be in many of the States. But even in these sections it is important that the principles of forestry should be enforced to prevent the destruction, so prevalent, by fire and the lumberman's waste, for at the present rate of cutting in the lumbering districts these virgin forests will in a few years be laid under contribution to supply the great markets of the country.

Forestry has proved remunerative in Europe, where it has been under government patronage and protection for 150 years, and where wood and timber are in good demand at high prices. There is no guesswork about the results there. The book-keeping is thorough and the balance-sheet reliable. Prussia, from her 6,000,000 acres of state forests, receives an annual net income of about $7,000,000. Saxony, from her 400,000 acres of forest lands, receives an annual net income of about $1,250,000. Bavaria, from her 3,000,000 acres, receives annually, after paying all expenses, a net profit of $4,500,000.

ALSATIAN FORESTS.

The report of these forests, made the present year by United States Consul Ballow, of Kehl, to the State Department at Washington, gives some important facts bearing upon the profits realized from systematic, scientific forestry, to which I am indebted for the following facts:

The forests of Alsace-Lorraine cover 35.59 per cent. of the whole territory. The most important of these are in the Vosges mountains, the highest peak of which is 4,300 feet. They were the most important in France before the war of 1870, and are

only excelled by the forests of Baden in Germany. The government and the communities are the principal owners of all these forest lands, amounting to 1,109,660 acres. The government owns of these 336,600 acres—*i. e.*, the government of Alsace-Lorraine; the government and the communities, 42,955; the communities, 496,040; and private parties, 234,665 acres. The government forests are managed by a chief of foresters, with a salary of $2,200, three conservators at $1,800, nine inspectors at $1,600, 63 chief foresters at $1,200, and 275 common foresters and guards at $400 to $500 per annum. Chief foresters and common foresters have free lodging and fuel in addition to their pay.

All forests, no matter to whom they belong, are placed under the supervision of the forest administration, and the latter regulates the cutting. Not even owners of private forests are allowed to cut down their own wood without the consent of the government.

For the cutting and replanting of a forest in the Vosges a period of 120 years is required. During that time the forest is depopulated and renewed.

The average annual gross receipts of the government forests of Alsace-Lorraine, for the last ten years, was $1,786,948, and the average annual expenditure for the same time was $596,684, leaving an annual net income to the government of $1,192,114, or $3.20 per acre.

A large proportion of the forest lands of Europe, and especially in Prussia, has been reclaimed from almost barren wastes, or were lands naturally of little value for agricultural purposes. Their administration furnishes employment to many thousands, yields to the government a large annual income after paying all expenses, even to the support of schools of forestry, experiment stations, etc., while by their climatic and hydrographic influence they render the country more productive and better able to support a dense population.

REFORESTING WASTE LANDS.

In the New England and middle States forests may be grown with little expense and trouble. Fields worn out and abandoned or cleared lands not fit for agriculture and yielding little or no pasture can often be renewed by simply protecting them from browsing cattle and fires. Trees spring up naturally and thickly, and often of good variety. A little expenditure of time and money in sowing or planting the seed of valuable timber trees will insure the growth of a crop that is sure to yield a good return. The wooded area of some of the New England States has increased in the past few years through the mere neglect of the worn out and apparently useless lands, and the lumber product of second-growth white pine is now from 300,000,000 to 400,000,000 feet annually. Frequent examples in New England attest the fact that the rocky hillsides, when protected, soon become covered with a dense second growth of young trees that hide the barrenness of the scene and afford a protecting shelter to the adjoining fields.

But these embryo forests are worthy of more attention than to be simply let alone. Intelligent care in thinning and pruning and utilizing as the growth warrants may add a hundred fold to the value.

A farming country should have not less than 25 per cent. of its area in woodland. In general, outside the prairie States, this proportion can be set aside from lands of little or no real value for agricultural purposes. There is hardly a farm in New England of 100 acres that would not be greatly augmented in value by devoting this proportion to the cultivation and maintenance of woodland, and the same may be safely affirmed of every other portion of the country. And when farmers come to realize this fact they will no longer look upon the wood lot as of little comparative worth, ready to be cleared on the first demand, but will place a just estimate upon its value, and will discern its influence on the rest of the farm in protecting from destructive winds, in holding moisture against the droughts of summer, in modifying the extremes of heat and cold, in rendering the fruit crop surer, and in being, to a certain extent, the conservator of health, while it yields abundantly of its product for the farm.

The words of the late Horace Greeley, in speaking of the available opportunity for timber culture in Westchester county, N. Y., are well worth quoting here. He says:

"Were all the rocky crests and rugged acclivities of our country bounteously wooded once more, and kept so for a generation, our floods would be less injurious, our springs unfailing, and our streams more constant and equable; our blasts would be less bitter, and our gales less destructive to fruit; we should have vastly more birds to delight us with their melody and aid us with our not very successful war with devouring insects; we should grow peaches, cherries, and other delicate fruits, which the violent caprices of our seasons and the remorseless devastations of our visi-

ble and insect enemies have all but annihilated; and we should keep more cows and make more milk on two-thirds of the land now devoted to grass than we actually do from the whole of it. And what is true of Westchester is measurably true of every county in the Union."

FORESTRY ECONOMIES.

Statisticians have furnished us with alarming facts relating to the consumption of forestry products in this country and the consequent rapid decrease of our forest area. These facts have been widely published through official reports and commented upon by the public press. Yet so important are they as the basis for urging upon the people and the National and State governments the necessity for adopting and enforcing measures looking to the prevention of timber waste and the preservation of necessary forest areas that I venture to repeat some of them here.

Prof. Egleston, Chief of the Forestry Bureau at Washington, from the mass of statistics gathered on the subject, estimates the total value of all the annual products of our forests at not less than $800,000,000, outmeasuring the value of our great cereal crop, that of corn; about double our wheat crop; more than that of our crops of hay, rye, oats, barley, buckwheat, potatoes, and tobacco taken together, and ten times that of all our mines of gold and silver. Prof. Sargeant made the estimate for 1880 of more than $700,000,000.

The capital invested in the United States in the lumber business – *i. e.*, in the business of manufacturing lumber in 1880, was, according to the census return, $181,186,122. The total value of our lumber product for that year is given at $233,367,729, while the estimated value of the cord-wood used for domestic purposes was $321,962,373.

The New England States had invested at the same time in the lumbering business $16,641,326, and produced a lumber product valued at $19,271,914; and the value of the cord wood consumed for domestic purposes that year amounts to $16,242,801.

FOREST FIRES.

In addition to the contribution of our forests as above indicated, they suffer an enormous loss from fires and browsing animals. The forest area burned over in the census year of 1880 in the United States, as estimated by Prof. Sargent, was 10,274,089 acres, involving a loss of $25,462,250, beside the incalculable injury done to the soil, which in many instances rendered the burned region incapable of reforesting. "Fire and browsing animals," says Prof. Sargent, "inflict greater permanent injury upon the forests of the country than the axe, recklessly and wastefully as it is generally used against them."

RAILROAD TIES.

The large and rapidly increasing demands made upon our forests in the supply of railroad ties alone are impressively shown by Prof. Egleston in his report on forestry issued last year, to which I am indebted for the facts following: There is now in use in this country about 150,000 miles of railroads, which have required 396,000,000 ties, or the wood supplied by 3,390,000 acres, an area larger than that of the States of Rhode Island and Connecticut. Estimating that ties need to be renewed on an average once in seven years, there must be drawn from the forest annually 56,571,428 ties, requiring the timber growing on 565,714 acres. Allowing 30 years as the time necessary to produce trees of proper dimensions for ties, it will require 16,971,420 acres of wood land to be kept constantly growing as a kind of railroad reserve in order to supply the annual needs of the existing roads. This constitutes an area larger than the States of New Hampshire, Vermont, and Massachusetts combined, or the States of New Jersey, Maryland, and Delaware, with the addition of Connecticut. It is more than 4 per cent. of the total area of wood land in the United States, exclusive of the Territories, and 3 per cent. of the area in the States and Territories together. With the rapid extension of our railroad systems, these figures will be proportionately increased. From these facts it would seem that the subject of forestry should receive the most favorable consideration from railroad corporations.

THE WHITE-PINE SUPPLY.

The general awakening to the interests of forestry among the people of the originally wooded States came largely through the wide-spread publication a few years ago of the alarming facts relating to the destruction and fast disappearing of white-pine forests of the United States and Canadas. When the people were convinced by the reports of the statisticians that the supply of this most valuable and extensively used

timber would last but a few years at the rate of consumption going on, and that they would have to look ere long for other timber to take its place, active inquiry began as to our whole timber supply, the comparative value of the different kinds in the mechanic arts, how long these would last on the present basis of demand, and what the prospects were for the future.

When the forestry bulletins, issued by Prof. C. S. Sargent from the Census Department, announced that in both the upper and lower peninsulas of Michigan there remained of standing white-pine timber, suitable for market, but 35,000,000,000 feet, board measure, and that in the census year of 1880 there had been cut in the State 4,396,211,000 feet, requiring only eight years at this rate to exhaust the supply; that in Wisconsin there were standing 41,000,000,000 feet, with a cut of about three billions (2,097,299,000) feet for that year, leaving a supply that would last but fourteen years; that in Minnesota there were remaining 8,170,000,000 feet, and that 541,000,000 (540,997,000) were cut in the census year, leaving a supply for fifteen years, that at this rate the supply of white-pine lumber would be exhausted in these three States in the brief period of about twelve years, the question of the future supply of this most valuable timber became serious to the business world.

The late James Little, of Montreal, in 1882, said of the supply of white pine in Canada that he had consulted with the best authorities, and was pursuaded that, at the rate of cutting then going on, the whole supply of the provinces of Quebec, Ontario, New Brunswick, and Nova Scotia would be used up in about ten years. According to these estimates, then, the supply of white pine will soon be exhausted, and the mechanic arts will have to look to other fields for their supply of wood and timber. In view of this vast industrial interest the protection and conservation of our forests demands the earnest attention of our people and of the National and State Governments.

FORESTRY EDUCATION.

We have no schools as yet in this country which provide for a systematic training in forestry. The time for this, perhaps, has not ripened. The foundation, however, has been laid through the establishment of a few experiment stations, the general agitation of the question by forestry, agricultural, and horticultural associations and the public press. One of the most effective means employed thus far has been the institution of

ARBOR DAY.

Tree-planting on Arbor day, for economic purposes in the great West, has given to the prairie States many thousand acres of new forests, and inspired the people with a sense of their great value, not only for economic purposes, but for climatic and meteorological purposes as well. The celebration of Arbor day by the public schools in several of the older States by the planting of memorial trees, as originated at Cincinnati in the spring of 1882, and generally known as the "Cincinnati plan," has done much also to awaken a widespread interest in the study of trees; and this annual celebration promises to become as general in the public schools and among the people as the observance of May day in England. "Whatever you would have appear in the Nation's life you must introduce into the public schools." Train the youth into a love for trees, instruct them in the elements of forestry, and the wisdom of this old German proverb will be realized.

AGRICULTURAL COLLEGES.

In 1862 the National Government donated to the several States 9,600,000 acres of the public domain for the support of colleges of agriculture and the mechanic arts. There are forty-two of these schools that have received their *pro rata* of these lands, or the right to them. With a few notable exceptions the subject of forestry is not known in their curriculum. Every agricultural school in the country should give a prominent place to this study. While it is not feasible, nor perhaps advisable, yet to give an extended course in forestry instruction, it seems to me inexcusable not to give such general instruction as to lead the student to appreciate and care for the wood lot as well as the tilled field. The growing of timber is like the growing of a crop, to be cared for intelligently, to be utilized wisely, and to be cut and used when ripe for it. In connection with every one of these colleges there should be a forestry experiment station, conducted with a special view to the needs of the locality in which the school is situated. The advantages of these stations are obvious when we consider the almost absolute want of reliable scientific data in this country on which to found a general system of forestry management.

GOVERNMENT LANDS.

The National Government still owns about 85,000,000 acres of forest lands. These are without effective protection against the depredations of lumbermen. Hundreds of thousands of dollars' worth of timber is stolen annually from the public domain, and the destruction by fire is going on unchecked. Portions of these forests lie on the headwaters of the most important rivers of the continent, and their destruction would cause incalculable loss to the Nation. These forest lands should be promptly withdrawn from sale, efficient measures should be adopted to protect them against loss by theft and fire; such portions as are deemed necessary to the water supply and for climatic purposes should be dedicated forever to forest preserves, and the balance put back upon the market at a fair valuation. In the meantime, such timber should be sold to the lumbermen as the business demand and the interests of forestry might require. This important interest should be placed, by law, in charge of the Forestry Bureau of the Agricultural Department, with ample appropriations for attaining these ends.

I have thus called your attention to some of the features of forestry that I deem most worthy of consideration. Your papers and discussions will embrace a much wider field, and I trust that we shall come to some definite conclusions, and take definite action with reference to some things that should be done the coming year in furtherance of our cause.

In this connection, and finally, I venture to suggest—

1. That action be taken by the Congress with regard to securing appropriate legislation by the National and State Governments.

2. That plans be devised and methods adopted for promoting forestry education in our institutions of learning, for the continued spread and still more efficient celebration of Arbor day, and the organization of local forestry associations.

3. That special consideration be given to the relation of forestry to commerce—*i. e.*, railroads and navigable streams.

4. That steps be taken toward collecting and classifying reliable statistics in America (the United States and Canada) relating to our forests, and making them a part of our annual report, stamped with the authority of this Congress.

CONCLUSION.

"I have written many verses," says Holmes, "but the best poems I have produced are the trees I planted on the hillside which overlooks the broad meadows, scalloped and rounded at their edges by loops of the sinuous Housatonic." May the work done at this session of the American Forestry Congress result in adding many a like poem to the landscape, and in adding a powerful impetus toward the protection, the conservation, and wise utilization of our forest wealth.

At the close of the President's address, the reading of the minutes of the last meeting being next in order, on motion, the reading was dispensed with.

As the call was next made for the report of the Recording Secretary, the absence of Dr. Hough, hitherto always present at the meetings of the Congress, was perceptibly felt. His recent death was announced by Mr. Egleston, and a committee was appointed for the purpose of making proper expression of the sentiments of the body in view of his decease.

Mr. George Noyes, of Boston, was then chosen temporary Secretary in place of Dr. Hough.

The report of the Corresponding Secretary, Mr. B. E. Fernow, was then read as follows:

REPORT OF THE CORRESPONDING SECRETARY.

When a year ago it was your pleasure, against my strong advice, to entrust me again with the office of Secretary to your Association, I undertook once more the task with that diffidence which the magnitude of the work before me, as in comparison with the insufficiency of means and facilities at my disposal, would naturally add to a proper conception of my own shortcomings.

I assured you that my good will would have to stand for what I could not bring to the office, namely, experience in this class of work, a large personal acquaintance with the workers in the field, and plenty of time for correspondence with them, in order to bring about united direction of work, and to keep public sentiment warm to the interests of our cause.

These requisites being more or less absent, as well as the funds necessary for any diffusive propaganda, the slow progress in our work of reform must be understood. We can only expect to work in a small way and very gradually break the ground, until more means are at our disposal for specific work and the diffusion of our publications to a larger extent.

It has been my suggestion that the proceedings of this Congress would find a wider range of usefulness if, instead of being published in one volume, their publication would be distributed through a series of bulletins, in which could at the same time be noted the progress in the development of the forestry movement, and constant intercourse could be kept up between our friends. It was also expected that the cost of such publication would be largely covered by subscription. With this in view, the January bulletin was prepared in a rather more expensive style than at first contemplated. But, while kind commendations of the work were not lacking, sufficient patronage could not be secured to continue these issues on a subscription basis. In consequence, the proceedings and papers read at the Saratoga meeting remain still unpublished; the same is true of those read at Montreal and Cincinnati, to a large extent. It is suggested that these should be carefully sifted and the most valuable papers published, together with the report of the present meeting.

As our work can bear fruit only by a liberal diffusion of our published proceedings the most important problem for solution remains: How shall a more general and generous support be secured? In this we must keep in mind that our Congress is still more or less a benevolent society, which must look for their financial support to the generosity of their members and patrons. It will be different when this Congress represents an association of professional foresters, who in joining together advance their own personal aims and the interests of their profession. At present we are only a reform association, and cannot accomplish anything without expending on the education of the large mass.

The next problem in importance is, "How can we make our work most valuable?" and in this the possibilities are only limited by our facility in solving the first. Allow me, however, to point out a few possibilities of improvement. First of all we must personally produce at our meeting only work of some special value. In view of the still frequently vague writings on the subject of forestry I would repeat the injunction not to rely on mere authoritative statements. Generalities on forest preservation or forest destruction and forestal influences have become trite and their constant reiteration without positive data will dull the interest of listeners and readers, create suspicion and defection. We need definite, well-authenticated local observations, arrived at by well-described scientific methods; we need methodical work in establishing the conditions of growth for different species, their behavior towards the soil and towards each other in different soils, their rate of growth at different periods of life under different conditions. In fact, besides making propaganda, we should by concerted effort establish the principles upon which the forestry we advocate is to be carried on. Therefore, secondly, we ought to find means of engaging those men who by their profession are led to such studies as are germane to forestry problems to give more definite attention to these problems; we ought to count them in our ranks, and whilst their membership in our Congress will lift its work to a higher level their individual efforts will acquire that force and momentum which such an association will impart.

Thirdly. Our work in promoting proper legislation, in inducing the establishment of Arbor days and procuring other means of advancing our cause, must be largely done by committees during the intervals between our meetings. It is therefore of the highest moment that whoever accepts the appointment to such committee work should be imbued with the importance of such a trust, and not undertake it unless he is willing and can with sincerity devote himself to its discharge. Except for the committee on Arbor day and the painstaking work of Mr. Elizur Wright on the Mississippi reservoir committee, we have not done well in this respect.

In conclusion I would point out that the more the question of forestry is appreciated the more will grow a necessity of organizing local interests. In this question the Eastern mountain regions have different conditions, and consequently different aims to pursue from the treeless States of the West. The interests of the Northern States, with a largely denuded and decreasing forest area, differ from those of the vast forest wealth in the South.

We should as members of this Congress individually promote such association of local interest, by which means a systematic forestry may be much sooner secured in the aggregate than by an association which lacks the incentive of a direct benefit to a particular locality. Eventually this Congress will then be made up of the delegates from local associations, meeting to further the interests common to all.

Understanding this to be one of the duties of this Congress, your president and secretary undertook in the beginning of the year to organize the forestry interests in the

State of New York, taking advantage of the efforts that had been made in this direction by other parties without result. An enthusiastic meeting at Utica, called almost on the spur of the moment, inaugurated the New York State Forestry Association, which, but for some misunderstanding in its ranks, might have done better work in promoting the Adirondack forest legislation.

The Forest Commission for the State of New York has at last been established, and, with an appropriation of $15,000, should be able to show soon how a proper State forest administration may be organized, and, with what is left of State timber lands, should soon pay at least its own maintenance.

This year has also witnessed, under most favorable auspices, the formation of a Forestry Association in Colorado. So promptly and so well was its work done that, after a propaganda of a few months, Colorado could boast of the first Forest Commissioner in the States appointed to manage her forest reserves.

The Ohio Association has also succeeded in having a commission appointed for the purpose of advising in the management of her forestry interests.

California, too, has established a Forest Commission to experiment and study the requirements of different timber trees and similar questions of forest culture.

Thus it is shown that the agitation which we have carried on for now three years has found its reward and expression in a practical manner in all parts of the country.

As to the status of our Association, a few remarks will suffice.

From our member-list I find that we have 21 life members. We carry on our Treasurer's book 68 annual members, making a total of 89 members; but if we should apply the test of paid-up dues, this number would shrink considerably. We are not strong in numbers and must make up this deficiency in energy and earnest work. We mourn, therefore, the more the loss of our Recording Secretary and of the active and vigorous support of Dr. Hough. Perhaps no man in the Union deserves more credit for having not only invited timely attention to the needs of American forestry, but for the indefatigable industry and persevering energy with which he gathered valuable information and diffused it throughout the Union. Though not a man of original research, his name will lastingly be known among the pioneers of American forestry.

From the Treasurer's statement you will learn the modest sums which have been spent to pay for the issue of two bulletins of 2,000 copies each, the preparation for two annual meetings, and the incidental expenses of correspondence.

Our last two annual meetings have largely lacked the local support which must needs be enlisted to lend impressiveness to our proceedings. The welcome which we have met in this centre of intellectual life, and especially by the gentlemen of the Massachusetts Horticultural Society, must be the more gratefully acknowledged.

From this meeting we hope and expect fresh life and new impulse by enlisting the energetic and earnest work for which New England men have ever held the highest reputation.

BERNHARD E. FERNOW,
Cor. Secretary.

In the absence of the Treasurer his report was read, as follows:

REPORT OF THE TREASURER.

John S. Hicks, Treasurer, in Account with American Forestry Congress.

SEPTEMBER 15, 1885.

Received by Chas. Mohr, treasurer's balance		$203 47
life memberships		210 00
donation, Jos. S. Fay		10 00
members' dues and fees		83 00
bulletin subscriptions and advertisements		26 80
Expended:		
Stenographer's bill	$65 00	
Printer's bills	289 80	
Stationery	37 19	
Clerk hire	10 00	
Postage and expressage	85 07	
	487 06	
Balance on hand	46 21	
		533 27

Specification of Expenses.

Saratoga meeting, printer's bills	$10 60	
postage	19 10	
		29 70
Boston meeting, printer's bill and electrotypes	36 50	
postage	34 80	
		71 30
Bulletin No. 2, printer	63 32	
postage	8 50	
		71 82
Bulletin No. 3, printer and electrotypes	179 38	
postage	17 35	
		196 73
Letterheads and envelopes	30 42	
Rubber stamps	1 50	
Sundries, stationery	5 27	
		37 19
Sundry postage and express		5 32
Clerk hire		10 00
Stenographer		65 00
		487 06

Showing a balance on hand of $46.21.

After the appointment of sundry committees, the Congress adjourned to 2 o'clock p. m.

AFTERNOON SESSION.

The President called the Congress to order at 2 o'clock, when the Corresponding Secretary read communications from several persons expressing their inability to be present at the meeting of the Congress. The first was from Dr. Oliver Wendell Holmes, who, while expressing his regret that he was unable to attend the Congress, said he hoped the Congress would have influence sufficient to induce the country to retain "leaves enough to hide its nakedness, of which it is already coming to be ashamed." Letters of regret were also read from Prof. H. M. Seeley, of Middlebury College, Vermont; Governor Harrison, of Connecticut; Senator Warner Miller, chairman of the Forestry Committee of the United States Congress; Gen. W. Ward; Hon. Charles Francis Adams; Prof. C. K. Adams, of Cornell University; the Governor of Vermont, and Mr. H. C. Putnam. All expressed sympathy with the objects of the Congress and the hope that the session would be a successful one.

RESOLUTIONS IN REGARD TO DR. HOUGH.

The committee appointed in the morning in view of the death of Dr. Hough reported the following resolutions as expressive of the feelings of the Congress:

Resolved, That this Forestry Congress has heard with profound regret of the recent death of Dr. Franklin B. Hough, its Recording Secretary, and desires to place on its records its sense of obligation to him, not only as one of the founders of the Congress, and one of its most efficient officers from its beginning, but as one by whose indefatigable labors and zealous interest in the cause of forestry that subject was brought to the attention of the Congress of the United States, so as to secure favorable action by that body tending to the preservation of our wood lands, and whose exhaustive inquiries and comprehensive reports furnish a body of information on forestry unsurpassed for value and interest by any publication in the English language. The whole country is indebted to him as one of the chief instruments in arousing the people to a sense of the importance of maintaining a proper extent of forests, and for the interest in the subject which is already manifested.

Resolved, That this minute be placed upon the permanent records of this Congress, and that a copy of the same be transmitted to the family of Mr. Hough.

Remarks were made by several members in regard to the character and services of Dr. Hough, and the resolutions were adopted unanimously.

FACTS IN REGARD TO THE PRESENT STATE OF OUR FORESTS.

A large colored chart was suspended on one side of the platform, which had been prepared in the office of the Forestry Division of the Department of Agriculture at Washington, for the purpose of showing at a glance, by means of different colors, the extent of farmed lands, forests, and waste lands in each State and Territory.

Mr. Egleston, Chief of the Forestry Division, read a brief paper, in part explanatory of the chart, and giving some particular facts of special interest in connection with the subject. He spoke of the great difficulty of obtaining exact and satisfactory knowledge as to the extent of the forests, or the rate at which they are consumed. It is a vast country with which we are concerned, portions of it yet but sparsely settled, and much of it altogether unsurveyed. The Agricultural Report of the Census was a report as to farms, and took no account of the large area lying outside of the appropriated farms of the country. The Census of 1880 was the first to undertake an inquiry into the extent and character of the forests, and the volume prepared under the direction of Professor Sargent would be resorted to often as a treasury of facts on this important subject. Mr. Egleston gave some startling figures in regard to the consumption of the forests which is taking place.

Mr. Little, of Montreal, the well-known lumberman, who is equally well known for his intelligent views and his enthusiastic interest in forestry, while expressing his pleasure in listening to the statements of Mr. Egleston, said that the lumbermen were to blame for most of the forest fires. It was their careless and wasteful methods of lumbering that made forest fires possible. He himself had not lost more than one per cent. by fire in all his lumbering operations. It was the limbs of the trees, left by the lumbermen to wither and dry where the trees fell, instead of being removed, which afforded the ready fuel for any chance spark that might fall from the smoker's pipe or the unextinguished camp fire.

Mr. Merriam, of New York, corroborated the opinions expressed by Mr. Little.

The remainder of the afternoon was occupied in welcoming those who had come to the Congress as accredited delegates from various States and listening to the reports which they had to give in regard to the condition of forestry in the States represented by them. All the New England States were thus represented, together with others as distant as Nebraska and California. Applause broke out when ex-Governor Morton announced that as the result of premiums offered in Nebraska for the greatest number of trees planted on Arbor day 7,000,000 trees were planted in a single day.

The venerable Elizur Wright, active and enthusiastic as though forty, instead of eighty years old, made a very interesting statement in regard to the Middlesex Fells, and hoped the Congress would influence the Legislature to make this forest the property of Boston for the purposes of health and recreation.

EVENING MEETING.

The evening session of the Congress was designed to be of a more popular character than those of the daytime. Governor Robinson was present, and, on being introduced to the Congress by President Higley, addressed the body, as follows:

MR. PRESIDENT AND GENTLEMEN OF THE FORESTRY CONGRESS: Invited some weeks ago to be present here for a few moments to say something of greeting to you, in reading over the journals of this evening I found the most worthy chief magistrate of the city had already extended the welcome of the city of Boston to the Congress, and, knowing her abundant hospitality, I felt it would be almost useless for me to bid you welcome to the larger people. But one is so soon out of the woods in Boston—I do not mean politically—we feel like introducing you to something of the woodlands

outside, and so, speaking for the larger number of people outside the city, I bid you welcome to the State. During last winter a resolve was passed by the Legislature asking me to appoint five gentlemen to attend this Congress. I assure you it was a pleasure to me to do so, and I wished they might be able to be of some use to you in your deliberations. It is, therefore, with heartfelt satisfaction that I see these five gentlemen are present to attend to their duties. [Applause.] Nor would you expect anything different from Massachusetts or her subjects. She has the right to claim the position of being the first State to take into consideration this question. At the beginning of the present century the old State society of agriculture offered prizes for the development of forest growth, and so it has continued. There is a gentleman here who is credited with a magnificent sum for his devotion in planting trees. In 1837 the Government ordered a survey and inquiry into the growth of all the woodlands of the State. You know it resulted in the report of Mr. G. B. Emerson in 1846 to Governor Briggs, a work which deserves study at the present time. Indeed, it is a classic, as it were. As early as 1818 our people thought it to be of interest to look to the shipping interest, and so they provided that the Agricultural Department should provide encouragement for the growth of the oak, and that provision remains on the statute book to-day. Perhaps the agricultural societies do not know this at this time; perhaps because ship-building is not now of such great importance. Then in this State we have offered encouragement by the exemption of taxation, under certain conditions, to the owners of trees. Then penalties have been imposed for the wanton destruction of trees by fire. In 1882 an act was passed authorizing the cities and towns to raise money to make the forest lands public domain, so that the people may have the pleasure of them perpetually. Nor is that all. In 1884 it was my privilege, in addressing the Legislature, to bring the subject before the attention of that body, and it was deemed advisable to get every fact of importance, and the officer now charged with the State census is collecting all the statistics and data on this question, that it may be laid before some future Legislature. That is a most important step. Knowing the gentleman in charge of the census bureau, you know the work will be well done, and that the results will be entitled to confidence. Others far more at home on this subject than I am, and very likely gentlemen who have had more leisure recently to devote to the question, will address you and touch on these topics. But any man with eyes in his head and brains to direct his intellect knows the value of growing forests, even in these thickly-settled States. Time was when we were on the farm that we thought we were doing the highest service by destroying the trees, and year by year farmers have done all they could in reclaiming, as they call it, land that had better be left alone in the forest. [Applause.] Agriculture is not the pastime in Massachusetts that it is in the Western States, and those of us who began life with those days when we rode the horses to the stump know what it is. I say all such land would have been better land if left alone and the fallow kept away. Experience is proving the truth, because it is a fact that the acreage of the forests in the States during the last half century has not diminished. Certain lands have been abandoned for tillage, although the capacity for production of trees may have been seriously diminished. The whole question of water supply only needs to be touched upon. Boston may well say we are most interested in some practical solution of the question. Boston wants the clear water of the country from the woody forest, from the shade of the forest, where the air sweeps from every breeze. [Applause.] And we in the cities want life, energy, muscle, and spirit, and we expect to get it from the pure air. Start some fine morning out of sultry Boston and go to the woods of New Hampshire and Maine and try the effect, and you will come home ready to demonstrate that the air of the forest is good. Transplant that forest as near the city as you can, and let the young child and the old man breathe good air in the morning, at noon, and in the evening, and it will be a luxury. Then, in material concerns, the manufacturer who depends on water power is interested, so we in New England hope that out of this meeting the States will find they have a common interest. There is something that we may do in all places. We may not make a forest, for we may not own land enough for one, but wherever there is a dwelling, and wherever there runs a road or stands a school-house, a church, or a railway station, or a water trough beside the road where the animal stops to drink, there is a place for a shade. Then, if the animals could speak, how they would bless the man who planted the tree beside the water, so that he could enjoy the cool shade while he took his draught. We are glad to welcome you to Massachusetts. The Commonwealth gives you greeting, and hopes for a great success. [Loud applause.]

The Governor was followed by ex-Governor Morton, of Nebraska; Major Ben: Perley Poore, Hon. George B. Loring, and Dr. B. G. Northrop.

A letter from Hon. Warner Miller was read, expressing regret on account of his in-

ability to attend the Congress, and presenting for its consideration a bill which he had prepared and proposed to introduce at the approaching session of the National Congress, providing for the withholding from sale of all public lands which are timber lands and the appointment of a commission to survey these lands so as to determine which may properly be disposed of and which shall become permanent reservations. The letter and bill were referred to a committee, who subsequently reported a recommendation of the general provisions of the bill for adoption by the General Government, and the report of the committee was adopted.

Colonel Merriam, of New York, offered a resolution recommending the planting of memorial trees by the army posts of the country in connection with the commemorative exercises of Decoration day. The resolution was unanimously adopted.

SECOND DAY.

That was a remarkable scene presented to view on the opening of the second day's session of the Congress. The Hon. Marshall P. Wilder, known throughout the country and beyond it for his enthusiastic interest in horticulture, and who had recently celebrated his eighty-seventh birthday, was on the platform. Close at hand were Hon. Elizur Wright, in his eighty-second year, and Hon. Joseph S. Fay, who, not yet in his eighties, had come to invite the Congress to take a practical lesson in forestry by paying a visit to his planted forest of 200 acres and more on the southern shore of the Cape. And there were the white beards of ex-Governor Morton, Hon. Mr. Joly, of Quebec, and others, who were the leaders and enthusiasts in this Forestry Congress. Indeed, it might almost be said that the enthusiasm of the members and their manifest earnestness in the cause of forestry were proportioned to their age. This was like a reversal of the usual order of things, as we expect old men for counsel but young men for action. Is it because, as the lives of the trees are measured by centuries and the influences of forestal agency are developed slowly and cover large spaces, so it requires the observation of the larger part of man's ordinary lifetime to give him a proper apprehension of the importance that attaches to trees, and especially to forests?

Mr. Wilder, on being introduced by President Higley, was received with applause. Allusion having been made to his age in the President's remarks, he said he would never be so old as not to take interest in the object of this organization. He welcomed them to the Massachusetts Horticultural Hall in Boston. This society, he said, was the first of its kind incorporated in the country, and was the parent of many others. It had been the means of introducing ornamental trees, which originally came from the forest, and it was of the highest importance to protect the forests for the many useful purposes the timber served mankind. He said: "Go on; press on in your noble work, and future millions shall remember you with gratitude long after you have passed away." [Applause.] He said he had been a lover of nature from his youth, and hence his interest, and he loved everything in nature—the balmy spring, the glorious summer, the mellow autumn—and he loved dearly to be remembered by those who had for their object, as his hearers had, the health and happiness of the human race.

The first paper read this day was one by Mr. Egleston on "Forestry Legislation in the United States," in which he traced its progress from the earliest settlements of the country to the present time. He considered forestry legislation in the two aspects of laws for the protection of forests, as property, from theft and depredation by fire, and laws for the production or extension of forests by bounties on tree planting. The substance of the laws of each State was given, usually with the date of their enactment.

The Hon. M. Joly, of Quebec, in speaking on the forest economy of Canada, bore emphatic testimony to the practical usefulnesss of this Congress thus early in its history, showing how the Legislature of Canada had adopted the suggestions of the Con-

gress, and had thus placed Canada in advance of the United States in respect to forestry. In 1883 the Province of Quebec carried out the suggestion of this Congress by causing all lands unfit for agriculture to be set apart for the cultivation of timber. The Government would not allow any of its land which is unfit for cultivation to be allotted to the settler. It was a cruelty to allow him to settle on such land.

SMOKE-CONSUMING DEVICES.

A very interesting paper was read by Mr. Lander, superintendent of motive power on the Old Colony railroad, on the subject of "Smoke-consuming Devices for Locomotives." He gave a history of the attempts to arrest the sparks of locomotives as a relief to passengers, and for the purpose of preventing fires liable to be occasioned by them. He described the difficulties to be surmounted by any successful contrivance, and affirmed that these had finally been overcome, and that there were now such effective appliances that there is no good reason why there should be any further annoyance or danger from the sparks of locomotives.

This paper was of such interest and practical importance that it led to an animated discussion, and to the reference of the subject to the Committee on Legislation, who were charged to gather information on the use of spark arresters, and lay it before railroad commissioners in the several States and enjoin them to enforce the use of such appliances on all locomotives running through wooded regions.

STANDING COMMITTEE ON LEGISLATION.

The President was directed to appoint a standing Committee on Legislation, for the purpose of drafting bills touching forest legislation which are most desirable for the present. The committee were authorized to associate with them in each State proper persons who would co-operate with them.

ONTARIO COMMISSIONER'S REPORT.

An important report was received from the Hon. R. W. Phipps, forest commissioner of Ontario, giving facts of much practical interest.

AFTERNOON SESSION.

In the afternoon a paper was read by Hon. John E. Hobbs, of Maine, on the dependence of the lumbering interests upon systematic forestry. The paper abounded with interesting facts in regard to the production of lumber and the sources of future supply. The necessity of planting and cultivating forests was strongly urged.

A paper of much practical interest on the cultivation of the red cedar and the osier willow was read by Mr. Edmund Hersey, of Hingham. Mr. H. exhibited some shoots of the willow grown the present year which were nearly ten feet in length. They were grown on elevated and comparatively dry ground which had not been enriched.

Mr. Fernow read an interesting paper on the practicability of making use of the waste material of the lumberman as a fertilizer for the agriculturist. He said the experiment in Canada had already proved successful.

PLANTING OF EVERGREENS.

Mr. W. C. Strong read a paper on the transplanting of evergreens, giving his experience as to the best time of the year in which to do this work. This he has found to be in August, rather than at an earlier or later period, and he gave some physiological reasons in favor of summer planting.

ARBOR DAYS.

The subject of Arbor days had a hearty reception this afternoon, being brought before the body in a paper by Mr. Egleston, who urged that the observance of Arbor day was properly not for the prairie States alone, where it originated, but that it was needed in all the States, and was one of the most efficient means of promoting the cause of forestry throughout the country.

Mr. Peaslee, of Cincinnati, also sent a paper on the subject of Arbor day, in which he treated of the Ohio plan of connecting its celebration with the public schools and its happy results.

A standing committee on Arbor day was appointed, consisting of Dr. B. G. Northrop, Mr. Egleston, and Mr. J. B. Peaslee.

EVENING SESSION.

At the evening session the committee, to whom was referred the proposed bill of Senator Miller for national legislation to preserve a proper amount of the public timber lands, reported in the form of a resolution, commending the bill and referring it to the committee on legislation.

Rev. Dr. Mayo then enlivened the meeting by reading a paper in a somewhat different vein from the ordinary discussions, entitled the modern "Babes in the Woods."

The Hon. Norman J. Coleman, Commissioner of Agriculture, was then called out, and addressed the Congress for half an hour in a very earnest and spirited manner. He avowed himself fully in sympathy with the objects of the Congress. He desired the aid of the Congress. He wished to do some practical forestry work. But the Department of Agriculture was hampered in its forestry work by lack of means. Congress appropriated only $10,000 for the work needed throughout the whole country, when the single State of New York appropriated $15,000 for her own needs alone. He would have them urge their representatives in Congress to appropriate $50,000, and if ten times that were appropriated it would return a hundred fold. The remarks of the Commissioner were listened to with great attention, and at the close were applauded.

THURSDAY MORNING.

The two previous days, with their three sessions each, left but little of the indoor business of the Congress to be done, except that of a routine character and the choice of officers for the ensuing year.

Officers were chosen as follows:

President, Hon. Warren Higley, of New York.

First Vice-President, Hon. H. G. Joly, of Quebec.

Second Vice-President, Hon. J. Sterling Morton, of Nebraska.

Corresponding Secretary, Mr. B. E. Fernow, of New York.

Recording Secretary, Dr. N. H. Egleston, of Washington.

Treasurer, Mr. J. S. Hicks, of Roslyn, L. I.

Hon. B. G. Northrop, of Connecticut; Hon. William Little, of Montreal; Hon. J. B. Grinnell, of Iowa; Hon. J. G. Knapp, of Florida, and Mr. R. H. Warder, of Ohio, were chosen to be with the other officers of the Congress an Executive Committee.

MIDDLESEX FELLS.

Hon. Elizur Wright again urged the Congress to visit Middlesex Fells and see the capabilities of the tract from a forestal point of view. Here were 4,000 acres, the forests on which and the now ample water supply were threatened with destruction unless the tract could be purchased from the present proprietors and made a public domain. Mr. Wright said this was the only place in the immediate neighborhood

where the woods can be preserved and the water kept pure. There was enough pure water there to supply a million people with four and a half gallons daily.

PUBLISHING FUND.

Under the lead of the President an effort was made to secure a special fund for the purpose of publishing the valuable papers which had been read and others which had been prepared but could not be read for lack of time. In response to the President's invitation quite a number of those present subscribed $20 each to the proposed fund.

NEW ENGLAND LEGISLATIVE COMMITTEE.

A committee of twelve was appointed with special reference to the forest interests of the New England States. They were charged with the duty of memorializing the Governors and Legislatures of the States and to do all that is reasonably possible to secure a conservative forest policy which shall tend to mitigate the evils of forest fires and to encourage land owners to cultivate trees, with a view to maintain the vast resources of the lumber supply of the country. The following were appointed as members of the committee: Gen. Charles Hamlin, Bangor, and Hon. John E. Hobbs, North Berwick, for Maine; Mr. W. I. Ladd, Lancaster, and Mr. George B. Walker, of Concord, for New Hampshire; Mr. T. S. Gold, West Cornwall, and Hon. B. G. Northrop, Clinton, for Connecticut; Mr. W. C. Strong, Newton, and Mr. Francis H. Appleton, Boston, for Massachusetts; Mr. Henry G. Russell, West Greenwich, and Mr. Hathaway, for Rhode Island; Hon. Frederick Billings and Dr. Hiram Cutting, for Vermont.

The remainder of the forenoon was occupied with the reading of some brief papers and with statements in regard to the condition of forestry in various places. Major Phinney spoke of the successful planting of the pitch pine in Barnstable county, which had much enhanced the value of the land.

Mr. S. W. Powell, of Brooklyn, N. Y., read a paper on the requisites of an effective fire legislation, and Mr. E. B. Southwick, the botanist of the New York Central Park, exhibited a very interesting collection of specimens illustrating forestry. It occupied 50 cases, and consisted of nearly 500 specimens, embracing sections of wood, seeds, cones, acorns, wood fibres, fungi, galls, insect borings, cocoons, pith, bark, sawdust, and various other products of the woods.

On motion of Mr. Elizur Wright, the Legislative Committee was instructed to take into consideration the Middlesex Fells.

VOTES OF THANKS.

The usual vote of thanks was given to the reporters of the press, but in this case with more than the usual heartiness, for the reporters had given very full and accurate accounts of the meetings and of the papers read. Their work was spoken of by several members in connection with the passage of the vote of thanks. It was the manifest feeling of the Congress that they were greatly indebted to the Boston press for presenting the views of the Congress on forestal subjects to the public in such an appreciative and effective manner.

The thanks of the Congress were also given most heartily to the officers of the Massachusetts Horticultural Society for the use of their hall and for the courtesy and painstaking care with which they had made arrangements for the comfort and success of the Congress at its present meeting, and especially to Hon. Wm. C. Strong, chairman of the Committee of Arrangements, and to Mr. F. W. Brewer, of Hingham.

After a hearty vote of thanks to Governor Robinson and his Honor Mayor O'Brien the Congress adjourned to meet next year at such place as may be chosen by the Executive Committee.

But though the formal sessions of the Congress were now ended, much that was most enjoyable and of practical interest and utility in a forestry point of view yet remained for the members. In compliance with the invitation of the Mayor most of the members of the Congress and many of the ladies accompanying them took steamer at 2 o'clock in the afternoon for an excursion down the harbor and a visit to Deer Island, the site of the city's prison and reform school. The sail among the islands of the harbor was delightful and the visit to Deer Island was very interesting, giving all a favorable impression of the care and wisdom with which Boston watches over those who have been led to take the first steps in vice and seeks to reclaim them. Two hundred of the boys and girls were assembled in the neat chapel and welcomed the Congress with pleasant songs, accompanied by an organ and a band of instruments. After an inspection of the buildings an excellent collation was served, and the members of the Congress returned to the city about dusk.

EXCURSION TO WOOD'S HOLL.

The Forestry Congress, though a formal adjournment was made on Thursday, really continued its meeting through Friday by engaging in an excursion to Wood's Holl to inspect the forest of 200 acres which Mr. J. S. Fay, of this city, has grown there from seed planted at different times within the past twenty-five or thirty years. Not the least valuable of the sessions of the Congress were those held in the special car devoted to its use while on its way to Wood's Holl and back. The subjects which had been brought forward by the papers read in Horticultural Hall were discussed in a free way, while objects of interest in connection with forestry were constantly presented from the car windows. But the great meeting of the day was that at Wood's Holl. Mr. Fay was at the station on the arrival of the train, with a sufficient number of carriages to contain the members of the Congress, and two hours were spent in driving about the forest and hearing Mr. Fay's explanation of the method of his work. On as bare and wind-swept piece of ground as can be found, perhaps, along our coast and on poor soil, Mr. Fay began, years ago, to scatter over the trodden-down grass the seeds of our common yellow or pitch pine, and here to-day is a dense body of wood, in places almost impenetrable. Many of the trees are fifty or more feet in height. Having gained a foothold of pines, and thus raised a screen against the driving winds from the ocean, Mr. Fay planted behind them the seeds of other trees, evergreen and deciduous, and with unfailing success.

The members of the Congress were delighted to see this proof that forest trees can be so easily raised from seed under such unfavorable circumstances. It was a confirmation of what they had believed and taught, and nothing more convincing and encouraging could be asked for. Mr. Fay said, emphatically, that farming had not paid and would not pay in such a situation, but that raising of forests would.

After inspecting the forest the members of the Congress were invited into the house to partake of an excellent collation.

An invitation had been received from Professor Baird, in charge of the United States fish hatchery near by, to visit that establishment. The invitation was accepted, and the Congress spent an hour in looking over that interesting place and listening to Professor Baird's explanations of the work going on under his direction, after which, with hearty thanks given to Mr. Fay, who accompanied the members to the cars, they returned to the city at 7 o'clock, and then finally separated, and the Congress was closed.

SOME FACTS AND FIGURES IN RESPECT TO THE FORESTS OF THE COUNTRY AND THEIR CONSUMPTION.

BY N. H. EGLESTON,

Chief of the Division of Forestry, Department of Agriculture, Washington.

The census of 1880 embodies the results of the first attempt by the Government to ascertain the extent and character of the forests of the country as a whole. No previous census had undertaken to do more than to take note of the forests embraced in and forming a part of the *farms*. The volume prepared under the direction of Prof. Sargent is a most valuable compendium of information, and will often be resorted to as a treasury of facts in regard to the forest condition of the country. Of course it is not, and could not be, a complete account of the subject. The field of inquiry is too large and other sources of information are too limited at present to make this possible. Estimates must often be made where exact information cannot be obtained.

In the prosecution of its work the Forestry Division of the Department of Agriculture has been endeavoring from year to year to ascertain such additional facts as would enable it to present a more complete view of the condition of the country in respect to its forests than it had been possible to give before. To insure the utmost accuracy the estimates made by the Division, from the reports of its agents and all other sources of information, have been submitted for verification or correction to the Governors or other officers of the several States and Territories, and the result arrived at is given in the accompanying table:

The States.	Total land area.	Forest area.	Percentage of forest to total area.
	Acres.	*Acres.*	
Alabama	32,985,600	17,500,000	53.1
Arizona	72,268,800	10,000,000	13.8
Arkansas	33,948,800	20,000,000	58.9
California	99,827,200	20,000,000	20.0
Colorado	66,332,800	8,000,000	12.1
Connecticut	3,100,800	650,000	21.0
Dakota	94,528,000	3,000,000	3.0
Delaware	1,254,400	300,000	23.9
Florida	34,713,600	20,000,000	57.6
Georgia	37,747,200	18,000,000	47.7
Idaho	53,945,600	10,000,000	18.5
Illinois	35,840,000	3,500,000	9.8
Indiana	22,982,400	4,500,000	19.6
Iowa	35,504,000	2,300,000	12.7
Kansas	52,288,000	3,500,000	6.7
Kentucky	25,600,000	12,800,000	50.0
Louisiana	29,068,800	13,000,000	44.6
Maine	19,132,800	12,000,000	62.7
Maryland	6,310,400	2,000,000	31.7
Massachusetts	5,145,600	1,000,000	19.6
Michigan	36,755,200	14,000,000	38.1
Minnesota	50,591,200	22,000,000	43.4
Mississippi	29,657,600	13,000,000	44.0
Missouri	43,990,400	16,000,000	36.4
Montana	92,998,400	25,000,000	26.9
Nebraska	48,758,400	1,300,000	3.1
Nevada	70,233,600	2,000,000	2.8
New Hampshire	5,763,200	3,000,000	52.0
New Jersey	4,771,200	2,330,000	48.8
New Mexico	78,374,400	8,000,000	10.2
New York	30,476,800	8,000,000	26.2
North Carolina	31,091,200	18,000,000	57.9
Ohio	26,086,400	4,500,000	17.3
Oregon	60,518,400	20,000,000	33.0
Pennsylvania	28,790,400	7,000,000	24.3
Rhode Island	694,400	200,000	28.8
South Carolina	19,308,800	9,000,000	46.6
Tennessee	26,720,000	11,000,000	41.2
Texas	167,865,600	40,000,000	23.2
Utah	52,601,600	4,000,000	7.6
Vermont	5,846,400	1,900,000	32.5
Virginia	25,680,000	12,000,000	50.6
Washington	42,803,200	20,000,000	44.3
West Virginia	15,772,800	9,000,000	57.0
Wisconsin	34,848,000	17,000,000	48.8
Wyoming	62,448,000	7,800,000	10.9
The United States	1,856,070,400	479,080,000	26.4

In this table, in order to show the comparative extent of forest, only the land area available for use as farm or forest is given. The land occupied by towns and cities and that covered by large bodies of water, such as lakes, is excluded. Our whole available land surface, therefore, Alaska being left out of consideration, is 1,856,070,400 acres. The total forest area is 479,080,000 acres. The total farm area is 301,000,000. Of unimproved and waste lands, including "old fields," there are 1,082,018,980 acres.

In regard to the consumption of our forests, we have some very significant, if not startling, figures. We had in 1884, as reported in Poor's Manual of Railroads, 156,497 miles of track. The average number of ties used for each mile is 2,640, which would make the whole number used 413,152,080. As the roads generally demand the best timber, choosing young, thrifty trees, which will not commonly make more than two ties each, not more than one hundred ties can ordinarily be cut from an acre of timber land, though with proper cultivation the yield should be much larger. To build the existing roads, then, has required the available timber on 4,131,520 acres. The average duration of ties is seven years. To keep the existing roads in repair, therefore, will require 59,021,700 ties, or the product of 590,217 acres. The average length of new road built every year is about 5,000 miles, requiring 13,200,000 ties, or the timber of 132,000 acres. If we allow twenty-five years as the time necessary for trees to attain a size suitable for making ties, then it would require the annual growth of 14,755,425 acres to keep good the existing roads, and 3,300,000 to supply the annual demand for new roads, to say nothing of keeping the latter in repair; so that we need to hold in reserve not less than 18,000,000 acres of woodland for the maintenance of the road-beds of our railroads, aside from the additional demand for the building of cars, bridges, depots, and platforms. In other words, it would require the timber growing on an area larger than the States of New Hampshire, Vermont, Massachusetts, and Rhode Island combined. The census also reports that in 1880 forest fires consumed the trees on 10,274,089 acres, or an area equal to that of Massachusetts and New Jersey. The consumption of our forests for the supply of fuel for factories, locomotives, steamboats, stores, and dwellings requires the product of not less than 6,560,000 acres annually. The estimated cut of lumber last year would lay bare 5,600,000 acres. All other products of the forest, such as hewn timber, posts, telegraph poles, and miscellaneous articles, of which we have no definite reports, it may reasonably be supposed would clear 4,260,000 acres—making in all 27,416,306 acres of woodland. Making an allowance of 10 per cent. for any possible over-estimate, we still have 25,000,000 acres as the annual consumption of our forests, or 68,493 for every passing day. This would clear the State of Rhode Island, if it were entirely wooded, in ten days, or the States of Kentucky or Virginia in a single year.

We may well inquire, and ask the country to inquire with us, most earnestly, What can be done to lessen this drain upon our forests, by the prevention of the needless destruction occasioned by fires—two-fifths of all—and by a more economical use of those products of the forest which are legitimately called for?

ALARMING DESTRUCTION OF AMERICAN FORESTS.

BY WILLIAM LITTLE, OF MONTREAL, CANADA.

I shall make no apology for appearing before you to-night, except to express regret for my inability to properly impress upon your minds the importance of the subject that I shall present for your consideration. I allude to the alarming destruction of the forests of the United States and Canada, especially in those descriptions of timber that have furnished in the past—you may say three-fourths of the commercial timber of America—the White Pine and the Spruce.

That the constant drain made upon the forests of America for supplies of these invaluable woods should at last occasion a scarcity and compel economists to point to a time, in the very near future, when their total exhaustion may with confidence be predicted, unless prompt and intelligent measures be taken for their conservation, will not surprise those who have known the enormous demands made upon them, but it is questionable if many persons are prepared to realize how near at hand that time is.

Thinking men, aware of the facts and desirous of protecting the forests, have tried to forewarn the public of the actual state of things, but have only been ridiculed for their pains. Now, however, this matter has passed beyond the region of conjecture. The United States' supply of these woods has been carefully ascertained through investigations made in connection with the census, and that of Canada is so well known to those conversant with the subject as to give rise to the most serious apprehensions.

Respecting the United States' supply, Prof. Charles S. Sargent, Director of the Arnold Arboretum, Harvard University, and special agent in charge of Forestry Statistics of the United States Census, made the following statements three years ago, in a paper read before the Massachusetts State Board of Agriculture:

"The entire supply (white pine) growing in the United States and ready for the axe does not to-day greatly, if at all, exceed 80,000,000,000 feet, and this estimate includes the small and inferior trees, which a few years ago would not have been considered worth counting. The annual production of this lumber is not far from 10,000,000,000 feet, and the demand is constantly and rapidly increasing.

"The publication of these facts a few months ago has greatly increased, and, in some cases, more than doubled, the value of pine lands, and it does not require any particular powers of foresight to be able to predict that the price must advance to still higher figures. Enough is now known to permit the positive statement that no great unexplored body of this pine remains, and that, with the exception of the narrow redwood belt of the California coast, no North American forest can yield in quantity any substitute for it."

And again, in the same article, as if to emphasize his remarks respecting the disappearance of the white pine, he says:

"Fatal inroads have already been made into the great pine forests of the North Atlantic region. Its wealth has been lavished with an unsparing hand; it has been wantonly and stupidly cut, as if its resources were endless; what has not been sacrificed to the axe has been allowed to perish by fire. The pine of New England and New York has already disappeared. Pennsylvania is nearly stripped of her pine, which only a few years ago appeared inexhaustible. The great northwestern pine States—Michigan, Wisconsin, and Minnesota—can show only a few scattered remnants of the noble forests to which they owe their greatest prosperity, and which not even self-interest has saved from needless destruction."

This is the condition of the United States forests as described by a gentleman who was specially engaged by the Government, on account of his pre-eminent ability and high character, to thoroughly investigate the subject, and which was made two years after all reports had been given in, when any errors in calculations, if such existed, would be fully known. What does it show but that there was then barely eight years' supply of this timber? Since then three years' cut has been removed; so that to-day there is standing in the forests less than five years' stock of this timber, not only that of merchantable quality, but of all kinds, good or bad, large or small, old or young—timber convenient and accessible, as well as that more remote and inaccessible. So serious indeed are the facts that actually before another census report could be made, there would not be a foot of this timber to take into account, if the present reckless cutting should continue!

And now, if we turn to Canada, what do we find is the condition of things there? It would, of course, be easy to give my own views or those of my father, the late Mr.

James Little, of Montreal, who took the deepest interest in the subject of forestry in America; but instead of this we will quote from the valuable report on the Canadian forests submitted to the Government some seven years ago by the Hon. H. G. Joly, our honored vice-president, as member of the Dominion Council of Agriculture—a report which is replete with most valuable information and suggestions.

In this report we find, under the heading "State of our Forests," among other remarks—

"They (the forests) contain," says Mr. Joly, "a great variety of timber, but I will call your attention principally to the pine and spruce, as they form nearly all our export to Europe, and are really the produce of our forests; while the hard-wood we export, especially the fine oak, nearly all comes at present from the lake regions of the United States, as we have very little of our own left.

"For some years past," continues Mr. Joly, "the idea has been gaining ground among men who take an interest in the future of the country that our great pine and spruce forests are getting rapidly exhausted, and that before long a trade which enables us to export annually over twenty million dollars' worth of timber will shrink down to wofully reduced proportions.

"Thinking men have begun to sound the note of alarm, and we owe it to them, but especially to ourselves as a nation, to try and find out how far their previsions are likely to prove true."

Then, after showing what difficulty the inquiry presents, he says:

"Let us now try and make an inventory of the timber resources of the Dominion, beginning in the west. On the Pacific shores of the Dominion, in British Columbia, the bountiful gifts of Providence are still stored up for us, and the forests have scarcely been attacked by the lumberman. How long these treasures will last us and what advantages we shall derive from them depends in a great measure upon ourselves.

"From the Rocky Mountains to the province of Ontario there are scattered here and there certain tracts of well-timbered land, but they are the exception. That timber will be required for the local wants of the people who are now only beginning to settle on our fertile prairies."

It is now known that this prairie country will require thousands of millions of feet in excess of its own stock. The report goes on to say:

"The great forest of Canada, *par excellence*, is spread over that vast territory watered by the Ottawa, the St. Maurice, the Saguenay, and their tributaries, over one hundred thousand square miles in extent. Before drawing your attention more particularly to it I will mention our remaining timber limits, that cannot compare with it, either for size or resources. They are found in the Georgian Bay country; the Muskoka and Nipissing regions; the eastern townships of Quebec and south shore of the St. Lawrence to the gulf; the region on the north shore of the St. Lawrence, from the Saguenay down to the Bersimis, and, perhaps, still lower down, as far as Mingan, and the country watered by the St. John, the Miramichi, the Restigouche, and their tributaries. Those limits, in many places, are scattered and isolated; they have, with few exceptions (such as the Bersimis at the east and some newly-discovered pine tracts at the west, on Lake Superior), been worked for a long time, and cannot be expected to supply much longer any considerable quantity of first-quality pine; but they still contain an immense quantity of spruce, principally in the east, sufficient for a great many years' supply, if carefully worked and protected. The spruce, unlike the pine, reproduces itself with wonderful ease, and a good spruce country, carefully worked, where you leave untouched all the trees under a certain size, say twelve or thirteen inches at the foot, can be worked and worked again, after a very few years' rest, I might say, almost forever.

"As a match to the timber wealth of British Columbia in the west there have been lately discovered at the extreme east of British North America, in the recent explorations through the hitherto unknown interior of Newfoundland, magnificent forests. Let us hope that before long they will take their place among our Canadian forests.

"I will now return to the great Canadian forest—our great pine country—with its wonderful network of streams and its three great arteries, the Ottawa, the St. Maurice, and the Saguenay.

"Does it begin to show signs of exhaustion? Is it possible that in such a short time man has been able to make an impression upon those millions and millions of acres of forest?

"If there is no sign of exhaustion, what is the meaning of the complaints that come over the seas to us, every year louder and louder, about the falling off in quality and size of our pine, hitherto considered as the finest in the world? Are they no more than the ordinary complaints of the purchaser? I leave it to our lumbermen to answer.

"But, before they answer, I will ask them, why are they compelled to go now to such enormous distances for the really superior quality of pine they used to get so much nearer home a few years ago?

"Look at the map of that great region and you will see how little of it is now left untouched. On the Ontario side, all the most accessible tributaries of the Ottawa, the Madawaska, the Bonnechère, Mississippi, Petewawa, and others have been worked for years. The lumbermen are now round the eastern end of Lake Nipissing, with the Matawan for an outlet to the Ottawa, that can only be reached by a land road; they are still much further north on the shores of the Montreal river.

"On the Quebec side they have nearly reached the headwaters of all the great tributaries of the Ottawa, the Rivière Rouge, the Rivière du Lièvre, the Gatineau, with the Jean de Terre and Lake Kakebonga and the Lac des Rapides. They are now working three hundred miles higher up than Ottawa, as the river runs, on Lake Temiscamingue and the Keepawa.

"On the St. Maurice they are as far up as Lake Manouan on the western side of the river; its great tributaries on the eastern side—the Bostonnais and the Rivière Croche—have been deprived of the greatest part of their fine pine; it is now sought at the headwaters of those rivers.

"As for the Saguenay region it still contains a good deal of spruce, but there is only a limited extent of pine still untouched, or nearly so, south of Lake St. John, between the Metabetchouan and the headwaters of the Rivière Croche, near Commissioner's lake and Bouchette's lake. There is a little pine left north of Lake St. John, and a certain quantity on the River Shipsha and in the lower Saguenay on the Ste. Marguerite and Petit St. Jean, etc. As for the large rivers that flow into Lake St. John, the Chamouchoua, Mistassine, and Peribonca, the pine that was on the lower part of those rivers has been nearly all cut, and the remainder of their course, from their distant northern sources, is through an immense burnt-up wilderness, where the vegetable soil has been consumed by fire.

"That huge tract of lumber country, between the Ottawa and the St. Maurice, that separated (or rather appeared to separate) the lumbermen working on those two rivers by what seemed an inexhaustible and endless forest—that huge tract is tapped through and through, and the Ottawa lumberman has met the St. Maurice lumberman on the shores of Lake Manouan. A glance at the map will show what that means.

"Those who think that there will never be an end to our timber may say: 'We can still go north.'

"Not very far north. From Lake Temiscamingue and the Montreal river, on the shores of which the lumberman is plying his axe at this very moment, they cannot go very far north before they strike the height of lands dividing the St. Lawrence watershed from the Hudson's Bay, and the country is generally poor and barren. There is still some fine pine there, in what quantity is not known, along the headwaters of the Ottawa, but it cannot be brought down to market, at least as square timber, until very extensive and costly works have been executed for the improvement of the great Rapide des Quinze.

"Once over the heights that divide the St. Lawrence and Hudson's Bay watersheds one from the other, the streams, without which timber cannot be brought to market, all run to the north to James' Bay and Hudson's Bay. Those regions are generally represented as a huge barren wilderness, with little timber, and that mostly of a stunted growth.

"While every one admits the great value of the timber trade to Canada, no one would complain, in a new and sparsely-peopled country like ours, if the finest pine forests were to disappear and make room for fine farms. But, unfortunately, we cannot comfort ourselves with such hope, for the soil of the pine region is not generally favorable to agriculture, and when the pine disappears the farm does not very often take its place.

"Men are the same all over the world. They never set much value upon the free gifts of Providence, and disregard them in proportion to their abundance. Timber, fish, and game have been destroyed everywhere in the same way. When what appeared to be inexhaustible becomes exhausted, it then begins to be valuable, and we must pay for our experience.

"Our neighbors in the United States have applied to the destruction of their forests their almost superhuman activity and energy, and they are now worse off than

we are for timber. But their eyes are being opened. The President, in his last message, has earnestly drawn the attention of Congress to the subject, and the following quotation from the last annual report of the Secretary of the Interior shows how thoroughly they appreciate the gravity of the situation:

"'The rapidity with which this country is stripped of its forests must alarm every thinking man. It has been estimated by good authority that if we go on at the present rate, the supply of timber in the United States will, in less than twenty years, fall considerably short of our home necessities.

"'It is time that we should turn our earnest attention to this subject, which so seriously concerns our national prosperity.'"

And, after referring to the older settlements of the Province of Quebec being painfully bare of trees, Mr. Joly sums up his report on "the present state of our forests" by saying "that it is very far from satisfactory and leaves much room for improvement." But in his very able report he does not stop short at "the state of the forests," but shows his clear insight into everything appertaining to the subject by accounting for the facts of a continued overproduction of wood side by side with rapidly receding and diminishing supplies. In alluding to the overproduction he says:

"There cannot be a greater waste of any marketable commodity than by overproduction. It is unavoidable, as the extraordinary success of any given branch of industry is certain to produce it; but generally it does not take long after its fatal effects are felt before the evil cures itself. Unfortunately our timber trade is an exception to that rule. In the face of a glutted market we persist in our overproduction, as if we expect to relieve the market by glutting it still more.

"Overproduction in the timber trade is a greater evil than in any other business, as the raw material cannot be replaced for generations. With a few exceptions the lumbermen of Canada, as a rule, cannot stop their production of timber; they can scarcely curtail it.

"The lumbermen have indicated the remedy for overproduction, but have not been able to apply it. Each one is ready to admit that he (or rather his neighbor) is cutting too much timber, and that he would make more profit with a less quantity.

"It is bad enough that so much money should be wasted away in cutting down timber for no good, but if there were an inexhaustible supply of timber on the Crown lands, the Government, receiving a larger amount of timber dues than it might otherwise, would not be likely to interfere, to protect the lumberman against himself. But our forests are getting rapidly exhausted and their produce sacrificed, and it is a loss for Canada and for the lumberman.

"Of course the first result of a decrease in the production of timber, in so far as the Government is concerned, would be a corresponding decrease in the Crown lands receipts. I won't call it the revenue, because there is something deceptive in the use of that word. We are apt to fancy that it always means (as Worcester has it) the income or annual profit received from lands or other property. It is nothing of the kind in this case. We have not been spending the income or annual profits of our forests, but the forests themselves—not the interest, but the capital."

This is a picture drawn some seven years ago of the condition of the Canadian forests by a gentleman thoroughly conversant with the timber trade, an enthusiast on the subject of forestry, and having recourse to every available source of information on the subject. What can we gather from his statements but that Canada is almost in the same deplorable condition as the United States with regard to its stock of valuable pine timber? It may be here worthy of mention that, though Professor Sargent in his remarks made no reference to the condition of the spruce forests of his country, yet an examination of the Forestry Bulletins published by his department shows that the existing amount of spruce timber will have disappeared in as short a time as the pine, if the same rate of cutting should continue. Although Mr. Joly appears to consider that the spruce forests of Canada would supply the home consumption for a great many years, yet it would supply for but a limited period the thousands of millions of feet that will be required by the United States when it has parted with its white pine and spruce timber, and when it has no other source of

supply for this description of wood than Canada, and from no other source can it be obtained so cheaply.

It has often been said that there would be found a substitute for wood. If so, it is quite time the discoverer brought it forward, for up to the present the ingenuity of the "everlasting Yankee" has not even touched the subject. Notwithstanding the fences of wire, the use of iron in buildings, the terra cotta and straw lumber, the consumption of our old friend, wooden lumber, increased nearly 50 per cent. in the ten years from 1870 to 1880, the former being 12,755,543,000 feet and the latter 18,091,356,000 feet (we are now informed by the Hon. Mr. Egleston, Chief of Forestry Division at Washington, that the present production is not far from 28,000,000,000 feet); and though it has always been claimed that iron and lumber keep together, cheap lumber accompanying cheap iron, we now find iron so low that producers claim they are at the lowest rung of the ladder, while lumber, notwithstanding the enormous production, has advanced in price, with every prospect of still further increase; and yet it would appear that we are within five years of the time when the great bulk of supplies of white pine and spruce (which are, in the North, the great stock of this indispensable material) must cease. And this is not the statement of interested parties, which might be open to suspicion, but of those specially employed by the Government of the country to ascertain the true condition of the forests.

It will no doubt be said "What of this? There are still vast forests in the South to be drawn upon." This may be a matter of great value to the South; but to the people of the North, who now make and use four-fifths of the sawed lumber produced, it is a matter of the most serious importance. The value of the lumber now produced in the North exceeds $300,000,000 a year as it falls from the saw. That it is all wanted there is no better evidence than the fact that demand and price are both increasing, and to replace it would cost from two to three times this sum, even if the same lumber could be obtained elsewhere, which it cannot be. Six hundred million dollars a year would not replace it; so that, in a very short time, this section of the country, instead of having a great and profitable industry advancing and helping every interest, will be called upon to pay out hundreds of millions of dollars annually for such material.

But even our Southern friends are interested with us in the preservation of this timber, as the uses to which it is applied are so different from theirs that large quantities are annually sent South, and the government of Canada, recognizing this fact, while imposing a retaliatory duty on the white pine, admits southern pine duty free. It is further to be hoped that the governments of the Southern States may learn a lesson from the prodigality of the North, and preserve their most valuable timber for the benefit and welfare of the community, instead of giving it away to timber-land speculators, or to such an ignorant race of destructionists as have gobbled up the timber of the North, or they, too, will soon be dispossessed of one of the greatest blessings that Providence has vouchsafed their country.

When people talk, as they sometimes do, of the inexhaustible forests of the South they little know the sawing capacity of the Northern mills, which could in twelve months' time convert the whole merchantable pine of the States of Georgia or Alabama into lumber, and could in six months use up that of Florida or either of the Carolinas. In fact, the mind can hardly realize the enormous consumption of timber going on in the United States; but some idea may be formed of it from a knowledge of the fact that the city of Chicago alone received in one year over 2,000,000,000 feet, principally white pine, an amount equivalent to the entire production of the Dominion of Canada during the same period.

The entire annual consumption of wood for building and manufacturing purposes can now be but little short of 30,000,000,000 feet. This of itself must show the enormous destruction of forests going on in the United States, and the serious result a loss

of its timber must have upon its future welfare. It consequently becomes the greatest economic question of the day—one before which all others sink into insignificance in comparison, for nothing can be more true than the remarks of the Glasgow Herald, in reviewing an article on the subject in 1876, when it said: "The knowledge we have gained of a dearth of cotton may help us to appreciate the terribleness of the calamity that would be experienced from a dearth of timber in Canada and the States. In point of fact, both Canada and the States are busy sawing from under them the high-reaching, fortune-making branch, on which, like conquerors, they are now sitting and overlooking the world."

When we consider the importance that an abundance of the most valuable timber has had on the past welfare of the country, and come to realize what "a dearth of timber" means, all will readily see that the foregoing is by no means an overdrawn statement. If we also consider the fact that each human being in the country must have timber in one form or another for his protection or comfort—that our shelter is of timber, the floors we walk on, the chairs we sit on, the tables we eat from, the conveyances we use, even to our cradles and coffins—we can readily see how overwhelmingly important is this great question of timber supply. Then, too, the numerous industries engaged in the various processes concerned in the use of this material, and the hundreds of thousands of laborers directly depending thereon for their livelihood, prove that timber is an article required by every individual of the whole community, and demonstrate that every means should be adopted for its preservation and protection.

When England, which has cheap coal, cheap iron, and cheap labor, and which can get her supplies at the cheapest rates from the north of Europe, annually expends nearly $100,000,000 for timber, one can readily recognize how much it would cost the United States (a country that has yet to be built up) to import its lumber from any foreign source. It has been estimated that it would take the entire sailing tonnage of the world to convey the amount of timber annually consumed in America from any foreign lumber port. But where to get at any price the enormous quantities used in this country is a question that would puzzle those best informed on the subject to determine.

These considerations fully justify the remarks contained in a leader in the New York Sun, when urging Congress some time ago to remove duties from Canadian lumber, in which it said:

"No more vital question can come before Congress. Perhaps no Congress has ever been called on to decide an economic question of greater moment."

The Province of Quebec has, to some degree, acted prudently by restricting the cutting of pine trees below a certain size—12 inches at the butt on the stump; and the policy of charging the same timber dues on small logs as on larger ones has similarly had the effect of curtailing the cutting of the small spruce trees. But in the United States even this small measure of wise economy does not operate, as all trees, both large and small, are cut.

The word "destruction" has in the preceding remarks been used advisedly. American forests are not exploited as in Europe. To remove a large trunk sometimes fifty smaller trees are cut down, and this ruthless destruction is resorted to simply to save a small amount of extra labor; whereas the trees needlessly felled, as well as the tops and branches of the one actually required, are left to rot on the ground or, what is worse, to lie as fuel for the flames.

And respecting forest fires, which the lumberman is constantly parading as an excuse for his reckless cutting of timber, it may be said that, from the condition in which the woods are left during and after his operations, it would appear to require almost the interposition of Providence to prevent their burning in case of an acci-

dental spark falling among them. With proper legislation and an enlightened public opinion to lead Americans to look upon the tree as one of his best friends there should be but little danger from fire.

Moreover, if the timber-land owner would annually expend the same percentage he is willing to spend to insure other property of like value towards putting his timber property in a safe condition he could so place it that it would be difficult to set it on fire so as to do any serious injury.

I shall not advert to the climatic or other effects claimed to be of an injurious character which the clearance of the forests is said to bring upon a country. These matters are best treated by the scientific gentlemen assembled here. The commercial aspect of the question is all I claim to possess a knowledge of, and this I believe is of such paramount importance that it should arrest the attention of all thinking people.

It may be said that the active American mind, always ready with expedients, ought to be alive to its importance; but the truth is that the American mind has, up to the present time, been devoted towards getting rid of the timber, and in this, as in most other efforts, it has been eminently successful; so the question is now how to change the current of public opinion in America from that of antagonism against trees to that of appreciation of them. In my humble opinion this can soonest be brought about by constant agitation and reiteration of the true state of the facts. The formation of Forestry Associations and the institution of "Arbor Days" are having excellent effects, and will no doubt be productive of a great amount of good in this direction.

To the American, whose great aim has been how most quickly to get rid of the forests which, until recently, were the great obstacle in his way in providing himself and family with a home, the familiar refrain of "Woodman, spare that tree" sounded as the hollowest mockery; to him the rapid stroke and sharp ring of the woodman's axe, or the thud of the forest monarch as it struck the earth in its fall, were sounds far more pleasing to the ear. And it is only since the railways have spanned the continent and supplied the knowledge that his country is on the whole a prairie, and a treeless one rather than a wooded one—that the timber is only peculiar to the coasts, lakes, and water-courses, while the vast interior is bare of timber—that such an idea has had a chance of claiming his attention.

Respecting this aspect of the country, Professor Wm. H. Brewer, in the Statistical Atlas for the Census of 1870, writing of "The Woodlands and Forest Systems of the United States," says:

"A glance at the map shows large regions either treeless or very sparsely wooded, and that it is possible to cross the continent from the Pacific to the Gulf of Mexico without passing through a forest five miles in extent, or large enough to be indicated on the map."

And he might also have said from the Canadian boundary line to the same point, for he says:

"The woodlands of the east are separated from those of the west by a broad treeless plain from six to fifteen degrees wide."

And again, when mentioning the value of the "sawed lumber" product, he says:

"Yet this gives but an imperfect idea of the part that wood and timber play in the wants and industries of the people. The great majority of all the buildings of the country are made of it, and it is an essential ingredient of nearly all those which are nominally of brick or stone. It, too, is the principal ingredient in the vast majority of ships, boats, cars, carriages, etc., for transportation; so too of our furniture and of most of the tools and implements in use.

"It is the sole household fuel of two-thirds of the inhabitants of the country, and the partial fuel of nine-tenths of the remaining third. For making steam, reducing metals, and the various processes in the arts it is used in immense quantities. Entering, as it thus does, into the multiform uses of civilization, in every period of life from

the cradle to the coffin, a constituent of so many of our manufactures, and nearly all our structures, from a match or tooth-pick to the railroad or steamship, it forms an element in our needs and our industries which cannot be reached by statistics nor expressed by figures."

Even then he threw out the hint, which has since been realized, when he said—

"That our large timber, suitable for sawing, is diminishing, there is no question; nor is there any question that this will go on until the price so much rises that new timber will be planted as the old is cut, and that a part of this diminution is due to prodigal use and needless waste."

Also referring to this same time (1870), our lamented friend the late Dr. Franklin B. Hough, when Chief of Forestry in the Department at Washington, in his "Third Report on Forestry," p. 285, says:

"The United States, according to the last census, 1870, had an area of woodlands amounting to about 380,000,000 acres of land, belonging chiefly to individuals. It was estimated that 10,000,000 acres are destroyed annually and that not more than 10,000 acres are planted.

"It is only in the United States the devastation of the forests is going on upon an immense scale and made in some sense the order of the day."

Since then fifteen years have gone by, during which time the most terrible slaughter of the forests has been kept up. The increase of cutting for commercial purposes has more than doubled; so that, assuming these figures as correct, there can now remain but little more than one-half this area of woodland, for although, owing to five years of financial depression in the United States, from 1873 to 1878, the consumption of wood may have fallen off during that period, since then the onward stride has been so prodigious that the Northwestern States more than doubled their production of sawn woods from 1878 to 1884.

The 3,629 millions of 1878 become 8,000 millions in 1884, while a similarly large increase took place in the Southern States, so that the total cut of the United States is now over 50 per cent. greater than when the census was taken for 1880; but, considering the increase only 40 per cent. greater, we have for the entire cut of sawn lumber 25,000 millions of feet, board measure, of sawn wood alone; and if to this is added 20 per cent., to include the squared, flatted, and round timber, the wood used in shingles, pulp, etc., and the railway ties, fence-posts, and other forest products, we have a total of 30,000 million feet of wood used in commerce, besides the enormous amount used for fuel, etc., which was valued in 1880 at $321,962,000, and which would to-day be worth not less than $400,000,000. To obtain this enormous amount of material must have required the selection of the best trees from fully 20 million acres of land, equal to a strip of land 10 miles wide reaching from England to America, or more than four times the area of your whole State of Massachusetts.

These figures give some idea of the extent of territory denuded annually, and I will now show the present value of this material.

The value of "sawn lumber" returned for census year 1880 (actually the cut of 1879) was 233 million dollars; adding 40 per cent. to this, for increase since then, makes this amount 326 millions, and an increased value at primary points of 50 per cent. makes 489 millions, or, say, in round numbers, 500 million dollars for sawn wood alone. Then adding 20 per cent. of this value for other wood products mentioned above, equal to 100 millions, and the value of the fire-wood, 400 millions, the whole makes 1,000 million dollars as the present annual value of the forest products of the United States at primary points of production or manufacture.

Moreover, the production and consumption are steadily increasing, while the supply is as steadily diminishing; and when it is seen that this manufacture now stands at the head of the manufactures of the United States in value, as it has hitherto done in the number of operatives employed, and that the white pine, which has been in the past, and is still, the most important factor in this great industry, is rapidly approach-

ing extinction, I feel that we cannot be far astray in considering this, as regards America, what I have already called it, the most important economic question of the day—one before which all the others sink into insignificance.

The white pine, spruce, hemlock, and cedars form the bulk of the light woods of America, and it is probably owing to this characteristic that the white pine and spruce, notwithstanding their original great abundance, are so rapidly becoming exhausted, for, being light and easily floated, they are taken with but little difficulty from the most remote sections of the country, wherever water-courses exist.

It might be as well to remark, as opinions appear to prevail in some quarters that the area of the white pine in Canada is of very great extent; that it covers but a limited area. That this is a fact is shown by Dr. Bell, assistant director of the Geological Survey of Canada, in the report of the survey for 1880, in which he says, respecting the white pine, or what is known as the "yellow pine" of the British markets—*Pinus strobus*, L.:

"This and the next species have so nearly the same limit throughout the greater part of their northward range that they are represented on the map both by one line. The red pine, however, does not extend so far east as the white, so that in this direction the line represents only the boundary of the latter. Contrary to popular belief the white pine is confined to a comparatively small part of the Dominion, as will be observed by an inspection of the map. Its northern limit in Canada extends east as far as Mingan, while to the west it does not reach Lake Winnipeg, or Red river. It reaches its lowest latitude opposite to Ottawa City, about 48¾°, and its highest, about 52°, in the Lonely Lake region. In the country immediately north of Lake St. John the Messrs. Price have cut large quantities of fine white pine timber for export. When coming from Lake Mistassini to Ottawa, by way of the Gatineau river, Mr. Richardson, of the Geological Survey, first met this species at 230 miles north of that city. It occurs of fair size on the headwaters of all the principal branches of the Moose river, and in former times is said to have extended considerably further north along these streams; but, having been entirely destroyed by extensive forest fires, it has been replaced by other trees. Owing to these fires it is now very scarce in most of the region north of Lake Superior, but small groves of it have been observed as far north as represented It is scattered over the country between Lake Superior and the Winnipeg river and around Lonely Lake, but it is of rather small size. In approaching Lake Winnipeg the limiting line of this tree curves southwestward, and crosses the Winnipeg river about fifteen miles above Fort Alexander, and then runs south to the United States at some distance east of Red river."

In the foregoing remarks I have given the views of gentlemen in whose opinions I have the greatest confidence, and however much they may conflict with the preconceived notions of others, I believe them to be true.

But even if it were to take fifteen years instead of five to use up the whole of the white pine of the United States, or fifty years instead of twenty to use up the whole forests, the matter would be sufficiently serious to justify us in calling public attention to the facts.

In conclusion, I would add a few words written by Dr. Oswald on this most important subject:

"The true basis of national wealth is not gold, but wood. Forest destruction is the sin that has cost us our earthly paradise. War, pestilence, storms, fanaticism, and intemperance, together with all other mistakes and misfortunes, have not caused half as much permanent damage as that fatal crime against the fertility of our mother earth."

Mr. President and gentlemen, I fully appreciate the extent of the truth and the seriousness of the warning contained in those forcible words. We cannot too soon take active and vigorous measures to prevent, or at least to mitigate, the calamity which would befall our country if our timber, that great source of national wealth, is taken from us. From an economic, from a national, and from a domestic point of view I believe that the question of the preservation of our forests is the most important and the most vital one which the America of the present day has seriously to consider.

FOREST PRESERVATION IN CANADA.

BY A. T. DRUMMOND, MONTREAL.

Each of the provinces comprising the Dominion of Canada, excepting Manitoba, has control of its own Crown lands, and hence it is difficult to secure one uniform series of measures for the protection of the timber upon these Crown lands. Circumstances are different in each province. In British Columbia the forests are largely yet untouched, excepting along the Pacific coast, and there is thus the opportunity still there of carefully conserving the forests, so that they may be a continued source of revenue, instead of allowing fires and the lumberman's axe to have unrestricted sway among them. Between the Rocky Mountains and the boundaries of Ontario it it rather a question of how far forests are to be created, as the country is chiefly open prairie. In Ontario and Quebec, along the streams which fall into the Georgian Bay, and at the sources of the Ottawa, St. Maurice, and other great rivers and their tributaries, there is still a considerable area of white and red pine, but the trees are of diminished size compared with the splendid trunks common on the Ottawa twenty years ago. The lumbermen are fast approaching the northern limits of the growth of these trees. In Ontario the provincial finances are in good condition, and the Government there can, if it will, readily curtail its revenues from timber and timber limits, in order to prevent waste of its Crown lands, and to preserve them in condition to yield revenues to the Government and profit to the lumbermen who may work them in years in the future. In the Province of Quebec there is more difficulty in dealing with the question, as the Province has a very heavy funded debt, the interest of which, in addition to ordinary expenditure, has had to be provided for, and as a consequence every possible source of revenue has been made available to the utmost. New Brunswick has still some forests of pine and spruce, but the area is, compared with the Ontario and Quebec forests, relatively small, whilst Nova Scotia has, on the whole, but little timber of good merchantable size left, and has correspondingly less interest in the question of forest preservation. The Crown lands are under Dominion control only in Manitoba and the Northwest Territories, and some steps have been taken to preserve what timber exists there.

As is well known the system prevails in Canada of leasing from year to year large areas of Crown lands under the name of timber berths or timber limits, at an annual rental per square mile. Though the lease is from year to year, yet by custom it is understood that as long as the rent is paid the lessee may continue in possession indefinitely until he has cut off all the timber he desires. Sometimes the holder is merely a speculator; at other times he is a lumberman, who is keeping the limits in reserve for future working, and thus frequently large unworked areas are tied up from year to year by parties who have a quasi right to continue this under the original lease. This makes it difficult to apply new regulations to limits already under lease. Sections of country not yet under lease—and considerable new tracts have in Ontario been rendered accessible by the Canadian Pacific railway—are in a different position, and governments can readily lay down rules for their future working as timber limits.

Germany, France, Sweden, and India have their forests cared for under more or less stringent regulations, and even the small Province of Cape Colony, in South Africa, has its Forestry Department, under government control, and is doing a good work that should put us to shame. The forests there are being arranged for scientific working, the fundamental principle being, the conservator says, that the cutting shall not exceed the growth. Why should we in America, with a splendid heritage in the pine forests of Maine, Quebec, Ontario, Michigan, and Wisconsin, have been so prodigal and reckless, and have shown so little far-sightedness, as to have gone on from year to year for half a century past allowing this heritage to be diminished gradually in value without even an attempt to prevent it? How often are we blind to the future! The Cape Colony Report for 1884 very well puts it that the policy should be pursued of setting our faces against forest destruction as firmly as other moral evils are faced. Further than this, with us here, each State and each Province has an interest in the action which its neighboring State or Province takes or neglects to take on this question. Our great rivers have often their fountain heads, or the fountain heads of their tributaries, in one or more States or Provinces, and then course their way to the great lakes, or the sea, through other States or Provinces. Have not those whose lands along the route are watered by these rivers, the cities, towns, and villages which are scattered along their banks, and the public which makes use of the steamboats and other craft which ply upon their surface, an undeniable interest in seeing that these waterways are not impaired by the burning or cutting away of the forests at these fountain heads? It is the province of every State to legislate for itself, or to withhold

legislation, but in this case the neighboring States have a clear right to ask that their waterways and water supplies shall not be impaired or cut off by its neglect to provide proper legislation or proper oversight.

The remedial measures which I would suggest with a view to the preservation and renewal of our forests are in some respects equally applicable to the United States and to Canada.

The leases of timber areas I would restrict to definite periods of five or, at most, seven years, and when the lease expired the particular area covered by it should have a rest of, say, twenty-five years, to allow of the young trees attaining merchantable value. The effect of this would be to largely check speculation in timber limits and would give ample time to *bona-fide* lumbermen to get out all large-sized timber. It should be incumbent on each lessee to show his *bona fides* by erecting a mill within a given time either at or convenient to the limits, unless he has a special permit to work the limits for square timber.

The timber limits themselves should be restricted in size to about fifty square miles. This is now done in Manitoba by the Dominion Government. The parceling out of the timber country into definite, limited areas would enable each Government to carry out more systematically the plan of alternate leases and rests for the forests.

The production of square timber should be discouraged on account of the great waste of material in forming the square log and because of the additional food for forest fires which this waste material creates.

The cutting on Crown lands of trees under twelve inches at the stump should be punishable by a heavy fine, which would be easily collectible at the mills when the drives of logs come down after the spring freshets. This would have the effect of preserving the younger trees until they attained a merchantable size.

The starting of forest fires should be made criminal. Nineteen-twentieths of the forest fires are preventable. There is no reason why camp fires should not be put out, and the knowledge that to allow them to spread was punished by imprisonment would quickly make camp parties careful, more especially if every member of each party were made responsible.

Not only in the forests which have been cut over by the lumbermen, but wherever fires have swept through areas of Crown lands not specially suitable or available for settlement, resowing or replanting should take place. Where burned areas are left to themselves trees of a less desirable kind almost invariably spring up. How to effect this resowing and replanting economically is a question of some importance. It can be done in part by the forest-rangers, hereafter referred to, but I think that, as a condition of every lease of timber limits, it should be made incumbent on the lessee either to pay a given sum per square mile of territory included in his lease towards the expenses of the Forestry Department of the Government or that he should actually plant and care for a young tree for every trunk he fells. This would not be an expensive proceeding. It would involve the cultivation of one or, perhaps, two acres as a forest nursery and the subsequent setting out of the young trees, and to this might be added the duty of collecting and sowing through the forest of seeds of desirable kinds of trees. When it is remembered that each forester in Cape Colony is expected, without assistance, to annually raise 40,000 young trees, and that his duties involve the transplanting of these to the burned and other districts within his section, it will be observed that the task thus proposed to be imposed on the American lumberman is not formidable.

Lastly, each government, in the case of provinces still possessing forest areas of importance, should organize a Forestry Department in connection with the management of its Crown lands. The objects of the Department would be—

First. The general preservation of the forests from fires and from deterioration by improper working.

Second. The replanting of the Crown forests where burned or exhausted.

Third. The encouragement of tree-planting by land-owners generally, and the dissemination of information about trees and tree-culture.

There should be a Superintendent of Woods and Forests, whose duties should be organization, general supervision, and frequent inspection. Under him would be forest rangers or foresters, who would have given districts, in which they would reside, and for the oversight of which they would be responsible, their duties being to prevent encroachment by lumbermen on unleased Crown lands; to see that small trees were not cut; to investigate the cause of every fire happening within their districts and to punish the guilty parties, for which purpose they should have certain magisterial powers; to raise in a small plantation young trees for replanting the burned districts, and to collect and sow the seeds of desirable kinds of trees. Each forester would probably require the aid of an assistant. The administration of the department need

not be expensive, and whilst the expense could be readily met by a small tax per square mile of timber limits under lease, or per thousand feet of lumber sawn, or cubic feet of square timber produced, the saving annually of timber trees from forest fires alone would pay the cost of the department for many years.

LUMBERING IN CANADA.

BY J. K. WARD, MONTREAL, CANADA.

Mr. President, Ladies, and Gentlemen: I do not purpose on this occasion to take up much of your time with preliminary remarks other than to say that the paper I have prepared will be better understood by practical lumbermen than by scientists or amateurs. My aim will be to speak only of what it has been my fortune to learn in the rough school of experience. A lumberman's life is not passed on a bed of roses, yet there is a charm about it to those who have the stamina to endure its hardships and enjoy its excitements that is not easily forgotten by those who have followed the log drive from early morn to sundown, never feeling the time long, kedging across the lake to the tune of the chanteur or breaking the jam in the roaring cascade, whose noise is drowned by the yells and shouts of the crew on seeing the great mass move off, each great log, as it were, trying to get ahead of its neighbor until they reach still water. What excitement after the risks run and efforts made! Old lumbermen can and do look back to such scenes with as much pride as those who have faced battle. It has been said truly that peace hath its victories as well as war. The lumbermen can reasonably say so. What other business has so many contingencies connected with it, apart from the ordinary mishaps in trade? Sometimes there is too much snow, again too little. On other occasions the ice or the floods carry away your booms and scatter the logs, to be often stolen. Fires also cause much loss to the lumberman, and a great deal has yet to be done by legislation and by private effort to prevent the waste of such valuable property.

I have often thought we might have companies who would make a specialty of insuring this class of property, making the conditions and restrictions so thorough that proprietors would be necessitated to look after all intruders on their lands, whether hunters or careless settlers.

The different Provinces of the Dominion make the regulations and conditions on which the timber lands can be worked. In Ontario and Quebec vacant territory is usually sold by auction (in blocks varying in size from one to fifty square miles) at prices ranging from two to five hundred dollars per mile. In addition to this the lessee pays two dollars annual ground-rent per mile, and also a stumpage on all timber cut on the territory occupied. Each Province has its tariff of prices. In Ontario red and white pine are subject to 1½ cents per cubic foot—other woods vary in price; pine, bass-wood and cotton-wood saw-logs, 15 cents per 200 feet, B. M.; walnut, oak, and maple logs, 25 cents per 200 feet; hemlock, spruce, and other woods, 10 cents per 200 feet; railway timber, knees, &c., 15 per cent. ad valorem. In Quebec, oak and walnut pay a duty of 4 cents per cubic foot; pine and other square timber, 2 cents; pine saw-logs average about $1.25 per 1,000 feet, B. M.; spruce and hemlock saw-logs, about 60 cents per 1,000 feet; railroad ties, 2 cents each; all other woods, from telegraph poles to spruce spars, shingle woods, &c., pay different prices. All land owned by Ontario and Quebec is leased for lumbering purposes. Much of it, however, is of such poor quality that I doubt if it will be of any value except for producing timber. Lands considered suitable for settlement are surveyed, and as fast as the lots are taken up by settlers and the Government conditions complied with—that is, a house built and ten acres cleared on each one hundred acres—the lot is taken out of the license, the Government, however, reserving the pine, except what the settler requires for his own use on the land. New Brunswick contains a large quantity of spruce, tamarac, cedar, hemlock, and hardwood. The pine, for which this Province was once famous, has mostly disappeared. The timber lands of this Province—about two-fifths of its area—are still vacant, and the output of lumber and timber of various sorts cannot be less than 300,000,000 feet, B. M., per annum. The stumpage on spruce and pine logs is 80 cents per 1,000 feet, B. M.; on pine and hardwood timber, 80 cents per ton; railway ties, 2 cents each—this is in addition to the prices paid for the right of cutting that may be realized at auction, the upset price being $8 per square mile. Nova Scotia contains a good deal of spruce, hemlock, and hardwood. Much of the latter is exported.

Manitoba and the Northwest are not reputed to contain a great deal of timber, and what there is is largely spruce and small pine, and not more than is required for

home use. Canada, west of the Rocky Mountains, contains vast quantities of valuable timber, the manufacture of which is rapidly increasing to meet the wants of the Pacific coasts and islands, and there is little doubt that when the Canada Pacific railroad is finished much of this lumber will find its way east into the treeless prairies.

And now as to Canada's method of lumbering. When circumstances will permit we pile or skid before the snow becomes too deep. When the snow is deep we draw direc from the stump to the lake or river. Our shanty living is not, as a general thing, as delicate as in American shanties, though perhaps as substantial—less apple-sauce, tarts, and sweets and more pea-soup, pork, and bread and beans, with well-cooked tea—less milk or sugar. The style of living and buildings differs in various parts of the country, and until very recently, particularly on the lower St. Lawrence, the fare of the shanty men was very primitive, the commonest tea being quite a luxury, and the only variety in the bill of fare was that it consisted in pea-soup, bread, pork and beans for dinner; the same, with the addition of tea, for supper, and either, less the pea-soup, for breakfast. On the St. Maurice, for many years, the living has been good and substantial, with comfortable shanties provided with stoves, tables, and bunks, the cooking being usually done in an outside apartment. The shanty man's condition, however, is improving with the times. His lot, at best, is a hard one, and I do not wonder at the Curé, whom I once knew, and who visited the shanties periodically, when he said that it was penance enough for any poor fellow to be in the woods all the winter.

Our shanty-men, whether English or French, as a rule, are as good axemen, and, I believe, are as expert drivers and canoe-men as can be found in any country. The improvement in driving tools within the last thirty years has been great. Our people are also well up in dam-building as well as making slides and clearing away and blasting bowlders to facilitate driving. Our rivers as a general thing, being very precipitous and rapid, require extensive improvements, especially for the running of square timber. The quantity of this made at present, I am glad to say, is much less than formerly. Some years ago there were not less than eighteen million cubic feet made in one year, while last year there were only five or six million feet, and the past winter not more than two million feet. There are many reasons for this change. Good pine timber is more difficult to get, and Southern pine is cheaper and better for some purposes, while the British consumer is finding out the folly of paying for and freighting slabs, sawdust, and the poor lumber that is found in the heart of almost every stick of timber. The result is that the quantity of sawed pine has increased, giving more work to our mill-men and others, as well as utilizing much valuable timber that would be left in the forest to rot, or make fuel to burn that still standing. As to the manufacturing of lumber in the saw-mills, it has been done until very recently in all large concerns by gate saws, but of late years circulars have come largely into use. The prejudice against lumber sawed by them was so great that it could not be sold except at a lower price than that produced by gate saws. This was occasioned by the want of skill on the part of sawyers, but this has been obviated to a great extent by workmen gaining experience in the management of rotary saws, so that some of the best sawed lumber going to market is made by them. But I believe that, were manufacturers less ambitious to see how much work could be done by a circular rather than to know how well it could be done, much valuable timber would be saved by working round a log, placing it properly on the carriage with regard to the cracks to be found in almost every large pine log and cutting parallel with the outside of a tapering log instead of with the centre of it, thereby saving the good lumber found on the outside of most logs and throwing away, if any, the poorer stuff found in the heart. The result would be, as every practical lumberman knows, much wider and more valuable lumber, as well as the conservation of that which cannot be reproduced in our day. I am not an alarmist as to our supply of pine timber, but I cannot consider a wanton waste of it other than a sin, when so much good lumber has been and is being thrown away, much of which could be utilized, giving labor and profit to many. It is a pity that more effort is not made to do so. I would suggest, what I have tried to practice for many years, that a person building a mill should put into it fifty per cent. more sawing capacity than some of the fast mills now in use possess.

Sawing, as they do, in twelve hours 40,000 or 50,000 feet with one circular saw, I will not say how well this can be done with one gang of men, but I would venture to say that it could be done, so as to get a good deal more money out of the same logs, by employing two rotaries, with the necessary trimming machinery, and giving the men sufficient time to set their logs properly on the carriage, turning them round as often as necessary so as to get all the wide lumber possible. This could be done by employing, say, one sawyer and three helpers for the additional saw, all the other labor being the same in either case, such as jacking and rousting logs, trimming, culling, and piling lumber by motive-power, almost the same, but this costs noth-

ing, sawdust supplying the fuel. The interest on extra capital employed would be small, and the result would be not to exceed ten dollars per day for wages and interest on cost of extra plant, while there can be no question but that there would be an increased value of from one to two dollars per thousand feet on the output, or from forty to eighty dollars per day saved. It does seem as if the lumbermen of the past, as well as many of the present day, entertained the idea that the supply of pine in Canada is inexhaustible, and were anxious to get rid of it as quickly as possible. Now, as a means of making our timber hold out as long as possible, I am decidedly of the opinion that the United States Government should gratify the lumber manufacturers and stick to protection, though a free-trader myself in all commodities, lumber included.

Now, a few words on the question of the influence of forests on rainfall. In the absence of satisfactory statistics on this point I think there can be no doubt as to the influence of forests in regulating the flow of water and preventing evaporation, thus lessening the danger arising from sudden and often destructive floods, the swamps and glades serving as reservoirs in bringing about this result. In reference to the propagation of timber I am quite satisfied that woods indigenous to our soil and climate require only space, of which we have plenty, and protection from fire and cattle, in order to be reproduced to almost any extent. I have seen lands that have been abandoned because they have been exhausted grow in a few years a good crop of thrifty timber.

Mr. Chairman, in conclusion, allow me to say that if I have said anything that will provoke discussion and tend to further the object we have in meeting here, or will be the means of contributing towards the protection of the material that adds so much to the beautifying and prosperity of our country, my efforts will not have been in vain.

LUMBER INTERESTS—THEIR DEPENDENCE ON SYSTEMATIC FORESTRY.

BY MR. JOHN E. HOBBS, OF NORTH BERWICK, MAINE.

Early Lumbering in Maine and New Hampshire.

On the 18th of July, 1634, the ship Pied Cowe, from London, arrived in the Piscataqua, having as a part of her cargo two saw-mills, and as passengers a party of carpenters to set them up. Both the material and the men were sent by Capt. John Mason, one of the earliest promoters of colonization on the New England coast.

One of these mills was erected at the falls of Newichawannock, at the head of tidewater, near the mouth of the river of that name, in South Berwick, Maine. After discharging her cargo and taking part of her lading on this river, the ship sailed for Saco, on the 18th of August, where she completed her loading with "cloave-boards" [clap-boards] and pipe-staves. This ship, with the barque Warwicke, had made a voyage to the Piscataqua in 1631, returning, probably, with a similar cargo.

Thus early had the settlers begun to cut and utilize the forests, with which they found the land covered. Saw-mills soon began to multiply, and their capacity was enlarged.

In 1650, a mill carrying eighteen saws, moved by one wheel, was erected near the mouth of the Newichawannock, about one mile above the one erected in 1634. We learn that in this later year Richard Leader was granted by a court held at Kittery, on the 11th day of March, "all the right to the privilege or mill-power on the little river known as Newichawannock, with the liberty and like property in all timber not yet appropriated to any town or person." It is said that the magnitude of Mr. Leader's operations gave the name of "Great Works" to the place, which afterwards became the name of the river.

In 1654 there was granted to him "all the pine trees up the little river, so far as the town bounds went, for the accommodation of his mill." For the privilege of cutting all this pine timber he was to pay the town an annual tax or royalty of £15 currency.

About 1640 Major Richard Waldron, from whom I am proud to claim descent, built saw-mills at Dover, N. H.; also other mills in 1648, and about this period grants were made of timber lands on all the branches of the Piscataqua. Just then there was great activity manifested in the development of lumbering as an industry, so much so that laws were required for the protection of the forests. To provide against waste, in 1656 it was ordered that if any inhabitant should "fall any pipe-stave or clap-board timber, and let it lay unused up one month, any other inhabitant might improve it as his own property."

At a town meeting of the inhabitants of Portsmouth in 1660 "a penalty of five shillings for every tree was imposed upon any inhabitant for cutting timber or any other wood from off the common, except for their own building, fencing, or firewood."

Stringent regulations, designed to guard against damage to the woods by fire, were made by several of the New England Colonies previous to 1650. Belknap tells us "that as early as 1668 the government of Massachusetts, under which the provinces of Maine and New Hampshire then were, had reserved for the public use all white pine trees of twenty-four inches in diameter at three feet from the ground. In King William's reign a surveyor of the woods was appointed by the crown, and an order was sent to the Earl of Bellomont to cause acts to be passed in his several governments for the preservation of the white pines. In 1708 a law made in New Hampshire prohibited the cutting of such trees as were twenty-four inches in diameter at twelve inches from the ground without leave of the surveyor, who was instructed by the Queen to mark with the broad arrow those which were or might be fit for the use of the navy, and to keep a register of them. These regulations, however, were easily evaded by those who knew the woods and were concerned in lumbering, though sometimes they were detected and fined." If the wise laws so early established by the first settlers had been continued and enforced by their successors to the present day there would be no necessity for this organization.

Since those early days the vast forests that then covered and adorned the continent, and which had often been renewed by the processes of nature, have been largely displaced by the hand of man, and the agency of man in hewing down these forests has so far outstripped their natural reproduction that the present generation is compelled to consider the best methods of conserving what now remains.

The interest which this wasteful destruction of the forests has aroused has produced nothing more valuable than Prof. Sargent's masterly report on the Forest Trees of North America, issued by the Census Office at Washington.

We learn from this report that the pine and spruce standing in the timber regions of this country in 1880, not including Oregon, Washington Territory, and Alaska, was estimated at about 300,000,000,000 feet, board measure.

This, if evenly distributed over the country in ratio to the population, would supply our present consumption of lumber, estimated at about 20,000,000,000 feet per annum, for fifteen years.

(No estimate is made of the hard-wood lumber or of the second growth of pine and spruce.)

But it so happens that more than one-half of our population, or 26,795,626, are found in the sixteen States north of the Potomac and Ohio and east of the Mississippi rivers. The amount of pine, spruce, and hemlock standing in the timber districts of this region of country in 1880 was estimated at about 111,000,000,000 feet, and we estimate the cut of lumber, including laths and shingles, for 1880 in these districts to have been about 7,434,000,000 feet. The total product in these States was about 13,648,000,000 feet.

This estimate is obtained by a computation confined to the sixteen States, based upon Prof. Sargent's report, which report applies to the entire country.

Thus we see that 6,214,000,000 feet of the entire product must have been cut from the woodlands contained in the farms of these States. These amount to 47,016,767 acres, showing an average product of 131 feet per acre.

This is far above the annual yield per acre of the spruce forests of Maine at the present time.

An annual cut of about 7,500,000,000 feet in the timber sections of Wisconsin, Michigan, New York, Pennsylvania, New Hampshire, and Maine will exhaust the estimated amount standing in these States in less than ten years, allowing nothing for growth. A continued supply of lumber from the woodlands contained in farms to the present extent cannot safely be counted upon.

In some of the States these wooded areas are rapidly diminishing, notably so in Ohio.

In this State the actual condition of the forests from year to year is better known, perhaps, than in any of the other States.

The assessors report annually, since 1873, the number of acres covered with wood, and from a comparison of these reports a constant diminution of these forest areas is shown.

In 1853 the woodlands covered 55.27 per cent. of the total area of the State. In 1870 they had fallen off to 38.51 per cent., and in 1881 they occupied only 22.53 per cent. These are awkward facts, which may be true to a somewhat less extent of many, if not all the other, States we have been considering.

The rapid rate at which the old forests are disappearing and the constantly diminishing area of woodlands contained in the farms of these States, as shown by these statistics, emphasize the fact that the present annual consumption of wood and lumber is far greater than the annual increment, and that the time is not far distant when these sources of supply will be entirely exhausted.

To prevent such a calamity, as far as possible, we should at once set about cultivating the forests we have, so as to increase to the utmost their productivity, and the reinvesture of all land now lying waste.

According to the census of 1870 12,755,543,000 feet, board measure, with other lumber products, were produced, valued at $210,159,327. In 1880 the product of lumber had increased to 18,091,386,000 feet of long lumber, and with other lumber products was valued at $233,367,729.

It must be borne in mind, however, that the average premium on gold in 1870 was 25.3 per cent.; consequently the value of the product of 1870 should be reduced 20 per cent. in order to make it compare with the value of the product of 1880, and thus diminished it will be $168,127,462, showing an increase in the value for that decade of 38 per cent., while the increase in population was 30 per cent. for the same time. The increase in the quantity of lumber manufactured was more than 41 per cent. in that of long lumber, and 70 per cent. in that of shingles, showing that the price of lumber, owing to overproduction, had diminished more than the premium on gold.

The timber lands remaining in the possession of the Government in 1880 amounted to 84,564,207 acres, being a small fraction of what once belonged to the public domain, and this is rapidly diminishing.

In California the destruction of the timber districts is swift, wasteful, and criminal on the part of the Government by permission. Occasionally some poor fellow is prosecuted for cutting trees for "shakes" (a rude kind of shingles used in the mountains), just to give out the appearance of zeal on the part of the officers charged with the duty of enforcing the laws, while the great combinations, constantly formed for the purchase of timber lands, continue their fraudulent entries and wrongful purchases of millions of acres of the best of it, and hold it in large tracts, and cut it up to suit the demands of the lumber trade.

Large tracts in Washington Territory, Oregon, and California have been thus entered under the various acts of Congress the present year, and this is all now in the hands of a few holders and mill-owners through secret contracts. Then, the sheep and cattle men set the forests on fire about the first of September every year to make larger the area of grazing in the forests for the following years, and leave the valuable forests of sugar pine covering the mountain slopes to inevitable destruction.

The law in reference to small holdings of timber is violated by most mill men. Their methods is to get their employees, or any one else who is willing, to enter what one individual only can enter, and then they purchase of that individual.

We find it stated from official sources that the total net revenue to the Government for the many millions of dollars' worth of lumber stolen from the public domain, and for which damages were sought to be recovered, amounted, from the beginning of records down to January, 1877, to but $154,373.74.

In strong contrast with the destructive and wicked policy prevailing in California is that of the present systematic working of the extensive timber lands of Northern Maine, which, as a recent writer says,* "still cover an extent seven times that of the famous Black Forest of Germany at its largest expansion in modern times. The States of Rhode Island, Connecticut, and Delaware could be lost together in our northern forests and still have about each a margin of wilderness sufficiently wide to make its exploration without a compass a work of desperate adventure."

The reckless and wasteful methods of cutting the timber which once prevailed in these forests have given place to a more sensible and conservative management, which insures the continuity of the present lumber supply, with a possible large increase.

Maine, whose escutcheon bears the image of the tree which has been the theme of the poet and the admiration of lovers of the beautiful, has also upon that escutcheon the word *Dirigo*. May we not hope that she will in this matter of systematic forestry point the way.

It is proper to state that the hopeful increase will be to a greater or less extent the result of the construction of railroads opening up timber lands in the past inaccessible for lumber operations.

The last commission for the valuation of the lands of the State increased the valuation of wild lands nearly $11,000,000, and the construction of the Megantic and International railroad through 130 miles of unbroken forest will add immensely to the value of those lands.

---

* Prof. Walter Wells.—"Water Power of Maine," Second Report, p. 24.

The system of cutting only the large trees and leaving the small ones to grow, allows the spruce forests to be profitably worked at stated periods, varying from ten to twenty years, and producing an amount equal to 100 feet per acre per annum. The land owners, generally, are not the "operators" in cutting and hauling the timber, but "permit" the right to cut at so much per 1,000 feet, retaining a lien upon the lumber for the price of stumpage. The licensee often assigns his "permit" to the merchant furnishing goods or supplies, as security, and generally sells his logs to manufacturers who own or lease the mills.

The "permits" to cut are restricted to some well-defined portion of the township, and the balance is undisturbed. The supervision of the lands is generally accomplished through the agency of the scaler, in winter months, while the cutting is going on; but large land owners keep surveyors employed at other times exploring and looking after trespassers.

Maine has stringent laws against fires, but private interest has generally proved a better preventive than litigation or severe penalties.

Along the rivers in Northern and Eastern Maine, which are the route of the logs to the mills, one can see signs posted warning persons to extinguish their fires. Hunters, fishing parties, and tourists, who were formerly careless, have learned better in late years.

Forest fires, which formerly caused serious damage every year, are now much less frequent in Maine and are the result of carelessness on the part of those who set them.

Tornadoes, which blow down trees, generally have been followed by fires in this State after the lapse of one or two years; and fires are sometimes caused by sparks from locomotives along the line of railroads in dry seasons, and they would be more frequent were it not for the naturally damp nature of the soil. Spark arresters have largely diminished this risk, however.

The best judges estimate that less than one-third of the wild lands of Maine has been cleared of original forest growth. That the reproductive power of our Maine forests is outstripping the axe-man at the present time there can be no doubt.

These forests were first worked for the pine timber, which is now nearly exhausted, large bodies of it remaining only in localities at present inaccessible. The townships in which this pine grew, for a number of years after the pine had been cut away were left unmolested. The pine in these townships was very generally followed by spruce and hard woods. These forests are now worked for the spruce and are yielding larger fortunes to their owners than were made from the pine.

The history of one township will illustrate the renascent power of these timber lands.

About sixty years ago, or about 1825, township No. 7, R. 5, Aroostook county, was sold for the pine to Gen. Hastings by Massachusetts for $7.50 per acre.

This land reverted to the State after the pine was removed and was sold about twenty years later for 25 cents per acre. It is now worth $2 an acre and has upon it 70,000,000 feet (board measure) of spruce. Cutting of an average of 100 feet per acre per annum is regurlarly carried on there.

As the cost of transportation to market enters largely into the question of profit, the construction of railroads in Northern Maine will add immensely to the value of her forests and make hard woods yield greater fortunes for their owners than either pine or spruce have done.

Systematic forestry involves a knowledge of the best systems of preserving the great natural timber areas of the land, together with an acquaintance with the conditions best adapted to the cultivation of forest trees.

Let us now turn our attention to the latter branch of our subject.

We have already stated that the present average product per acre from the woodlands contained in farms in the States lying north of the Ohio and east of the Mississippi rivers is 131 feet per acre.

This product can be increased from two to four fold by systematic cultivation.

In the State forests of Europe it is found that an acre of pine will produce on an average thirty thousand feet, board measure, in a century, which is equal to 300 feet per acre per annum.

Authorities can be multiplied to prove that 50,000 feet of white pine can be grown on one acre in from seventy-five to one hundred years here in New England by having the ground well stocked with trees in the start and by judicious thinning afterwards The thinnings will pay a profit after the trees are twenty-five years old.

Natural Succession.

The principle of the rotation of crops, and this is found to produce the best results in agriculture, is believed by many to apply equally well to forestry, and so it is

thought that the alternation of the different species of trees is a law of nature, and that this is her method of renovating a forest.

It is well known by European foresters, however, that some species of trees have been propagated on the same land for centuries, and that the production increases with each succeeding crop.

That land is made richer by the growth of forest trees upon it is a fact well known everywhere, and every one knows that it is made poorer by the growth of field crops. These live largely upon the mineral products of the soil, while forest trees tax the ground to the minimum.

The inorganic elements of the soil vary considerably in the quantities and qualities that enter into the composition of the different plants we cultivate, while these elements differ but little in the different species of trees. The alternation of species in tree growth, therefore, which is often observed, must be assigned to some other cause than exhaustion of the soil, for like begets like in the forest as everywhere else in nature, and such changes will be found, upon examination, generally to be due to causes external to the forests themselves.

The spontaneous renewal of a patch of forest that has been cut clean should not be expected, unless the ground has been seeded by the trees before their removal, or unless the seeds for a new growth can be readily supplied from an external source.

There are many isolated patches of forest, scattered over the farms of the Northern States and Canada, enclosed with pasture land, which are sometimes composed entirely of white pine trees, but more frequently they are a mixture of white pines and deciduous trees.

Such forests are often cut clean when they have come to maturity or before that time, and it frequently happens that only a sparse growth, if any, succeeds.

Occasionally, however, a dense growth of white pine immediately follows the forest removed, be it all or partly of white pine.

And this will always be so when the forest is cut in the winter following an abundant seeding of the white pines, and for this reason: Most of the deciduous trees seed annually—the soft maples and elms in May and June—and these vegetate in the season of their growth, if at all, and the seedlings of all, with few exceptions, are browsed by animals as soon as they spring up.

On the other hand, the white pines, which seed less frequently, mature their seeds in the autumn, and these will germinate in the spring, following the clearing of the forests, if the conditions be favorable thereto. But if such forests as above described are cut in a non-seeding year of the pines the natural reseeding of the land is precluded, or at least doubtful, and its seeding must come from an external source, and the character of the succeeding growth, if any, will be governed thereby. Hence the importance of the common practice in Europe of clearing narrow strips through a forest, the reseeding of the land being expected from the strips left standing on either side. In order to adapt this plan to the small woodlands found upon our farms it would be advisable to commence the clearing on the leeward side of a pine growth, leaving a strip standing on the windward side until the land cleared has been seeded from it, when that can be removed, excepting the fringe or outside trees, which should be left to complete the seeding of the last clearing.

Every one must have noticed how much more thickly the young pines come up on the leeward side of a pine growth or of a large pine tree standing alone than on other sides.

The westerly winds seem to do the most of the seed sowing for these trees.

By this plan an uniform growth, without vacancies, is quickly secured, which only occurs, as before stated, when the forest is cut in the winter following the seeding of the white pines in the autumn.

In forests that are composed of contiguous patches of white-pine trees and of deciduous and other trees, which completely shade the ground and from which live stock is excluded, the seedlings of the deciduous trees and those of the fir, spruce, and hemlock may be found growing in the shade of all the trees in the forest; but the seedling pines will be found growing only in the shade of the deciduous, and never in the shade of the parent trees, so long as the roof of the patch of pine forest remains unbroken.

Now, if such a forest be removed in a non-seeding year of the pines, the succeeding growth would be largely composed, if not wholly, of the other kinds of trees.

From these facts we infer that the alternation of white-pine forests and forests of deciduous trees, which is so often observed, is dependent upon the frequency of the seeding of the different kinds, the shade they require or can exist under in early life, together with the agency of man in cutting them, of animals in browsing them, and of fire in destroying both seedlings and seeds, rather than upon the exhaustion of any elements in the soil such as is produced by field crops.

From the fact that, although seedlings may spring up in the shade of their parent trees while the roof of the forest remains unbroken they will soon die, the working of a white-pine forest requires different management from that of a spruce forest. The spruce, while young, grows best in the shade.

Total clearance of a pine forest when the trees have come to maturity is better than partial, which leaves the tall and slender trees to be easily overturned by the wind.

That white-pine forests do succeed each other without any diminution in the vigor of their growth is evidenced in my own town, some sections of which have been noted for the production of this noble tree ever since the first settlement of the country.

The most valuable lot of white-pine timber cut within my remembrance was upon the homestead farm and the birthplace of the late Governor Goodwin, of New Hampshire. There yet remain on this land stumps of white-pine trees, which stumps were old one hundred years ago.

There is good reason for believing that some of them are the stumps of the pine trees reserved for masts for the navy, and marked with the broad arrow in Queen Anne's reign. To-day the entire tract where these growths stood is thickly covered with young pines that have sprung up since the removal of the last growth, there having been an abundant crop of cones on the trees in the autumn of 1879, the trees having been cut the following winter.

Failure of Succession.

Having spoken of the natural succession of forests I will next allude to the failure of succession. Large tracts of land can be found scattered throughout the Northern States of this country, given over to mosses and bushes. Not infrequently these patches of waste land are in the neighborhood of extensive growths of pine, hemlock, spruce, and the maples and other hard wood trees; but in spite of this propinquity these tracts of worthless vegetation will continue to be waste unless they are planted. In many cases the moss is so dense that there is hardly a cranny in which the seed of trees could find a lodgment. The difficulty does not lie in the soil, which is entirely adapted to the growth of pines; for it will be found wherever a tree has succeeded in getting a foothold that it grows as rapidly as the trees of the same kind grow in the surrounding forest.

Waste Lands Profitable for Lumber.

There are few soils so unsuited to vegetation or the raising of crops that they cannot be devoted with profit to the cultivation of forest trees. There are large tracts of land in the forest regions of this country, or where forests, within the memory of man, have been abundant, which are now lying entirely waste.

No farmer would be wise in selecting his arable land for the plantation of a forest; for the investment would be an injudicious one and would be attended with loss. But it is these waste places which can be utilized so as, we believe, to prove a sound investment. All of these facts are of the first importance in dealing with the systematic cultivation of forests and deserve our thorough consideration as fundamental elements in that business.

Increase of White Pines.

The White or Weymouth pine (*Pinus Strobus*) stands at the head of the list of all the timber trees of the Northern States and Canada. It is adapted to a greater variety of soils than any other tree, and it succeeds well on dry, sandy soils where no other than the pines will ever make valuable timber. Such land should always be devoted to the growth of pine forests. There are large tracts of such land in New England, now producing nothing of value, that would yield a good income to their owners if planted with this tree. We can take a hint from nature as to the best conditions for the germinating of the seeds of the white pine on moss-covered land or run-out pasture and field lands that we wish to afforest. None of us can have failed to notice, when riding along a highway through a pine forest, how much more thickly the seeds spring up on the broken edge of the roadside ditch than anywhere else. From this fact we may learn that the scratching of the ground with a harrow before or after the sowing of the seed would furnish the proper conditions for their germination and growth.

The seeds, as is well known, require two years for their maturity, and are ripe in September and October. The cones should be gathered as soon as they are ripe and before the scales have opened. This may be easily done by felling the trees then which are intended for cutting the following winter. In regard to the time for sowing the seed we think it is best always to follow nature in that respect.

The reader will do well to refer to the experience of Mr. Joseph Story Fay, of Wood's Holl, Mass., well known for his successful labors in tree planting on Cape

Cod, which he will find in the first U. S. Forestry Report, 1877, in the Forestry Report by Hon. R. W. Phipps, Forest Conservator of Ontario, 1884, and in several of the Reports of the Massachusetts Board of Agriculture.

Time forbids my undertaking to describe the different modes of planting and sowing the seeds of other forest trees in drills or in hills, where drills are precluded by the nature of the ground, or of the different modes of transplanting seedlings from the forest and nursery—all of which may be found fully treated in works on forestry and in the reports of the Commissioners of Forestry of the States that have such officers. Among them we would cite the Report of the Forestry Commission of New Hampshire for 1885, and the Forestry Report by Hon. R. W. Phipps, Forest Conservator of Ontario, 1884, and in the admirable Reports upon Forestry by Prof. N. H. Egleston and by the late Dr. Franklin B. Hough, prepared under the direction of the Commissioner of Agriculture at Washington. All of these methods, described by these authorities, have been attended with success when properly conducted and are more or less adapted to the different sections of the country.

Thin the Forest.

We now come to the consideration of the most important thing connected with forestal operations—that of thinning the trees, so as to have the requisite amount of light and shade—in order that they may make the most rapid growth consistent with their design for timber. This work has heretofore been sadly neglected by most owners of forest land. Nature has been left to do it in her own way, which is a very slow and unsatisfactory process. The work of thinning should be begun whenever there is too dense a collection of trees on the land. The sooner this is done the better for the trees. Until three or four years old the surplus trees can be pulled up as easily as weeds. Those which remain should have room to develop lateral branches and to assume a conical shape. When three feet high, they should be three to four feet apart. From beginning to end, or to the maturity of the crop, the thinning should be limited to the removal of those trees that have been outgrown by their more successful neighbors and to such as give no promise of making valuable timber—the most vigorous trees always being left to occupy the ground. The due proportion should constantly be preserved between the numerical strength of the trees and the protection to be derived from their mutual shading. Hon. John D. Lyman, of Exeter, N. H., who has given much attention to the subject of thinning, says that when thirty-five feet high at least one-third of the stem should be covered with living branches and should never have less than that in order to make rapid growth.

Modes of Encouraging Forestry.

The discussion of our subject cannot be complete without a consideration of methods by which the destruction of our forests can be modified and of the means which can be adopted to induce men to cultivate forest trees. We know that in the matter of economy nothing can be expected of the individual farmer; and that to engage in forestry as an enterprise, an inducement must be held out to him which shall make him prefer forest culture. A way to accomplish this is by State legislation—one method of which may be the exempting from taxation, or from the full rate thereof, of land which the farmer shall devote to the growth of forests.

Several of the States, those of Nebraska, Kansas, and Iowa, at one time offered considerable premiums for planting trees upon prairie land, but after a while they abandoned this policy. Nebraska, however, has returned to a system of encouragement, but in somewhat different form, giving a moderate premium for a limited time, and exempting from taxation the increase in value of the land derived from cultivating trees thereon.

The American Association for the Advancement of Science, in their memorial to he Governors of the States, adopted at their meeting held in Boston in August, 1880, proposed "a law that shall exempt from taxation the increased value of land from the planting of trees where none were growing, for such period as may appear proper, or until some profit may be realized from the plantation."

Maine, the pioneer, and until a comparatively recent period the leader, among the States in the lumber business, having forty-one per cent. of her farms covered with forests, early saw the necessity of inaugurating a State policy for encouraging the preservation and production of forest trees. Her Board of Agriculture in January, 1869, appointed a committee, consisting of Mr. Calvin Chamberlain and Stephen L. Goodale, Secretary of the Board, to present to the Legislature such suggestions as they might deem important to that end and to call the attention of Congress to the same subject. The memorial, drawn up by Mr. Chamberlain, is well worthy of perusal, but

its length prevents our insertion of it here. This action of the State Board of Agriculture was followed, three years after, by the passage of a law. This law provided for exemption from taxation for twenty years of land which should be planted or set apart for the growth and production of forest trees, and from which the primitive forest had been removed. Since the passage of this act the constitution of the State has been amended, and under that amendment it is a question for lawyers to what extent, if at all, this act is now operative.

We believe that without legislation, either in the form of premium or in the form of exemption from taxation, partial or total, tree culture is a profitable industry. It is the opinion of the Chief of the Division of Forestry, as expressed in his report submitted to Congress in 1882 "That, with due forethought and intelligent care, there is no cultivation that better repays the attention bestowed upon it than that of forest trees." To the extensive evidence tending to show the profitableness of forestry I will add the facts known to me concerning a piece of land in my own town. The land is that of Mr. James Junkins, who sold in 1881 the pine timber standing on about six acres in one body, amounting to 300,000 feet, which netted him $3,300, or about $550 per acre on the stump. This tract originally contained about nine acres.

The Boston and Maine railroad was built through it in 1873, and this cut off a portion of the lot. Mr. Junkins' father settled upon the farm, of which this tract was a part, about 1809. At that time this was the only patch of woodland on the farm, and some of the trees were large enough to split for fence poles. During the intervening period, and for about twenty-five years, ending about 1860, a large part of the firewood consumed and all the lumber used in repairing the fences and buildings on a well-managed one-hundred-acre farm were furnished from the thinnings of this lot. About thirty years ago, $200 worth of timber was sold from the thinnings at one time, and there have been sales at other times. This lot had been systematically thinned and trimmed for the seventy-two years, care having been taken to break off the dead limbs, and a long pole was used upon the lot, with a hook on the end, for the purpose. These trees had increased in diameter slowly the last twenty years. Some had made only two inches in seventeen years, or one inch in thickness all around the tree. They were twelve to thirty inches or more in diameter at the stump. As to the height of the trees, Mr. Junkins mentions one that he cut for shingles some years ago which was eighteen inches through on the stump and 113 feet long.

Mr. Junkins is of the opinion that 5,000 feet per annum had been cut from the lot for about thirty-five years previous to its final clearing. The data here given show, we think, that this lot must have paid a large interest on twenty dollars an acre, in the wood and lumber used on the farm. I will mention here, in passing, that while the year 1879, as above shown, was a seeding year of the white pine, the year 1881, when this lot was cut over, was a non-seeding year in that region, and that the young trees that have sprung up since on this land are few and far between.

If anybody be distrustful of the profitableness of thinning a forest as an enterprise devoted to the end of obtaining a lumber supply, let him consider the same measures from another point of view. Let his attention be directed to the cutting, using, and selling of the less valuable trees in his woodland, leaving the more valuable to grow into timber. If he will judiciously select his trees for wood, he will succeed in thinning his trees, whatever his purpose may be in doing so; and should he be unable to realize from his wood more than enough to pay for the labor involved, he will all the while, and without any cost to him, be improving his property, as a timber lot, in a high ratio.

As the great importance of forest culture is becoming constantly more fully realized, we heartily sympathize with all movements which tend to encourage it. But we believe that if the farmers should feel the force of the reasons which have led the Forestry Department to recommend so strongly the cultivation of trees, there would be less necessity for its stimulation by legislative aid. That the State should do all that is reasonably in its power to encourage forestry, is evidenced by the great importance attached to the subject throughout the Continent of Europe, every government of which has established a system of forest management; and in forests owned by general and local governments, and by institutions, a provision has been made to some extent for a perpetual supply, to the full limit of their capacity for timber growth.

In dealing with the subject of Systematic Forestry in its bearing on the "Lumber Interests," the enormous waste suffered from great fires deserves mention. One vital step in the prevention of this pest is the cultivation of an enlarged sentiment in respect to the worth of our forests. Many a one who would hesitate to trample down growing grain or tall grass, will wantonly expose to fire unbounded tracts of valuable woodland. It is hoped that our efforts in increasing the growing interest in the subject of forestry, will have a tendency to create a more tender care than has hitherto been felt for our woods. But if we cannot prevent the setting of forest fires, we may

be able to recommend methods by which their destructiveness will be diminished, and the loss to the individual owner rendered less severe. Thus an encouragement to the planting and fostering of our forests will arise.

In the first place, in planting tracts which shall constitute, either alone or in connection with other forests, a large area of woodland, we would recommend that roads be laid around and through the growth, and that at the early stages of planting the plow should be used around the plantation; and it has been recommended to double this furrow, burning over the intervening space when there is no wind. And the time suggested is a few days after the first heavy frost of autumn. These measures, we are aware, are not practicable in the great lumber regions of the country; but we regard them as expedient upon farms and large plantations. We think that such measures are advisable, likewise, along the lines of railways.

In some of the States there has been legislation exposing to liability for damages any railroad company whose engines shall set fire to woodlands. In some of these legislations this liability has been limited to the case in which proper preventions had not been taken in respect to the smoke-stacks of the engines and the like. We think that legislation tending to a higher degree of care on the part of railroad companies whose roads lie through farms with tree growth upon them, or through lumber regions, is of great importance to the lumber business of this country, not only in diminishing the destruction of timber, but in lessening a cause of discouragement to systematic forestry.

Another means of encouraging men to cultivate trees is that of forest-fire insurance. The business of insurance has proved an indispensable element in the civilization of mankind; without it commerce upon the seas upon a large scale would have been impossible. The perils to be incurred would have deterred the individual owner from the enterprise but for the protection afforded him by insurance.

But the same system has become almost universal in respect to risks upon land, and, of late years, has been extended on an enormous scale to lives and to accidents. We confidently anticipate that as the business of forestry shall become more attended to a great impetus will be given it by forest-fire insurance. The enlarged interest which the important subject of forest cultivation has awakened in our country within very recent years points unmistakably to the gravity of the subject which I have been discussing.

The framers of our Federal Constitution appreciated the necessity of conferring the power to regulate commerce upon the National Legislature, and could the great public importance of the preservation and cultivation of our forests have been appreciated by the fathers as clearly as they saw the necessity that intercourse between the States should be controlled by the central power, they would probably have recognized this necessity in the Constitution. But the matter has been left to be dealt with by the States individually, and it is hoped that the defect in the law will be supplied by a wide-spread and intelligent public sentiment.

ARBOR DAY OR TREE-PLANTING CELEBRATION.

BY JOHN B. PEASLEE, CINCINNATI.

"Arbor day," for the planting of trees for economic purposes, originated in Nebraska about twelve years ago, but the celebration of "Arbor Day" by planting memorial trees with literary and other exercises originated in Cincinnati,* at the organization of the American Forestry Congress, in 1882, at which time the Cincinnati public schools had the honor of introducing tree-planting celebrations into the public schools of our country; and it is a source of congratulation that our example has been extensively followed by the public schools of the United States and the Dominion of Canada. Through the efforts of State school superintendents Butcher, of West Virginia, and his successor, Prof. Morgan; Holcombe, of Indiana; Apgar, of New Jersey; Higbee, of Pennsylvania, and the school inspector of the Dominion of Canada, "Arbor Days" are designated, and the great school systems of these States and of the

---

*On the first Ohio "Arbor Day," April 27th, 1882, a great tree-planting celebration took place in Eden Park. The exercises consisted of a procession, of singing, of instrumental music, and of recitations, and speeches on trees and forestry, etc. On that day the following groves were planted and dedicated: "President's Grove," "Citizens' Memorial Grove," "Battle Grove," "Pioneers' Grove," and "Authors' Grove." The former by citizens of Cincinnati and members of the Congress, the latter by the public schools.

"These were the first *memorial* groves ever planted in America—the first public planting of trees in honor and in memory of authors, statesmen, soldiers, pioneers, and other distinguished citizens."—*Higley.*

Dominion celebrate the days after the "Cincinnati plan," as Dr. B. G. Northrop calls it. Two years ago the Governor of Nebraska, the State in which "Arbor Day" originated, in his proclamation, naming the day and offering the State reward to the person who would plant the greatest number of trees, called upon the schools "to plant memorial trees after the plan of some of the Eastern States"—*i. e.*, the "Cincinnati plan;" and last year Kansas followed. The schools in many places outside of the States named above have adopted this beautiful custom of planting memorial trees, attended by appropriate literary exercises.

In these celebrations not only teachers and pupils take part but also thousands of other citizens. In this way myriads of trees are planted and dedicated to authors, statesmen, soldiers, pioneers, and other distinguished citizens; but above all, through these celebrations, not only the children but the public at large are being educated to appreciate the great importance to the climate, soil productions, and to the health and beauty of the country, of the planting of trees, and the cultivation and conservation of forests.

Except in a few of the Western States that are almost destitute of natural forests, where the planting of groves and forests is a necessity on economic grounds, very little attention will be paid to "Arbor Days," however eloquently their objects are set forth in the proclamations of governors and in the circulars and addresses of forestry associations, unless the celebration feature is adopted, and this will most easily be done by having the public schools take hold of it. How important, therefore, that "Arbor Day" celebrations be kept up, year after year, by the public schools of the country.

As an aid to such celebrations, and for further information on the subject, I may be permitted to refer to a pamphlet prepared by me, with a preface by President Higley, entitled "Trees and tree planting, with exercises for the celebration of 'Arbor Day.'" The pamphlet contains, besides the exercises for celebration, many important facts relating to forestry, such as the influence of forests upon the water supply and floods, the mechanism of a tree, proportionate area of woodland, famous trees, constitution of village improvement societies, &c. The pamphlet is now published by the National Bureau of Education at Washington, and may be had without cost by applying to the Commissioner of Education. Its distribution was the means of inducing the Grand Army Post of New York to plant memorial trees last spring in honor of their dead companions.

ARBOR DAY.

BY J. STERLING MORTON, LINCOLN, NEBRASKA.

No invention to speed steamships across the Atlantic has originated among the natives of inland States, and no machinery for felling forests, extracting their stumps from the earth, and manufacturing lumber, has been created by the native dwellers upon the treeless plains of the West. The stimuli which have impelled the human mind to inventive and useful thought have always been the physical environments of the race.

Hence, forestry—tree planting, esthetic and economic—has received its greatest impetus from the prairies of the Northwest. Treelessness caused us all to think of trees just as poverty makes one work for wealth, or as sickness impels a desire and effort for health. The undulating and majestic meadows which reached from the west bank of the Missouri river to the foot-hills of the Rocky Mountains, when Kansas and Nebraska were first opened to settlement, in 1854, contained in all their millions upon millions of acres not a single forest. The soil, good and fat in food for all plant life, responded to the labor of the home-building pioneers with abundant and generous crops. But the shade and beauty of trees was everywhere absent, and so—just as the coming winter tells the provident man to lay in fuel—our conditions impelled us to plant trees, stimulated us to evolve laws encouraging forestry and conserving timber lands, and, finally, to originate and establish *Arbor Day*, to make it an anniversary for setting out orchards and forests, and to consecrate it by statutory enactment a legal holiday, and award premiums to those who best celebrated it by putting out the most trees in its observance. It has worked well in Nebraska, and we have growing in that State to-day more than 700,000 acres of trees which have been planted by human hands.

But, while we have local laws to protect forests and conserve timber lands, the national laws stimulate destruction of forests and protect the denuders of timber lands by a prohibitive minimum duty of two dollars a thousand feet upon all foreign forest

products. What single act of legislation can do so much immediate and effective service in behalf of forests in the United States as the absolute repeal of the high duties upon imported lumber of every variety? And why should Congress delay such legislation a single day? Protective duties for the lumber lords of Michigan and Wisconsin are destructive drains upon all the forests of the timbered States and upon all the pockets of the prairie States. What can a forestry congress do to preserve forests more effectually than to demand of the United States Congress the immediate and complete annihilation of those high and exorbitant duties upon foreign lumber which now stimulate forest destruction in every portion of the United States?

Observe the inconsistency of our national legislation upon this vital question. By the present tariff we pay a bounty for the cutting down and manufacturing into lumber of almost every variety of tree. And by the timber-culture act we pay bounties in millions of acres of the public domain every year for the sham planting of counterfeit forests—forests which no more resemble in value, in beauty, and in sanitary influences the primeval pines and oaks which we tariff to their destruction than a five-cent nickel resembles a twenty-dollar gold piece. And if such repealing legislation be not enacted—if the present duties on lumber be continued—how long will it be before the treelessness of the whole country shall so environ all the people that every American shall be stimulated by surrounding conditions, by those climatic changes, those constantly recurring swelling floods of the great rivers—such as Cincinnati has so recently experienced in the Ohio—by long-continued droughts and by cyclones careening over the shorn earth, each year with more and more frequency and more and more destructive force—how long, I say, before every citizen shall curse the giant system of legalized spoliation which the existing tariff has vitalized and energized against the woodlands of this fair and fertile country? While we on the prairies make miniature forests, you in the older States, by your daily consumption of forest products, make mighty and magnificent wastes and sustain tariff taxes in Congressional enactments which render impossible any amelioration by the importation of foreign lumber, and hasten inevitably and resistlessly the calamitous end of woodlands.

The inter-dependence of animal and vegetable life is undeviating and perpetual. We declare the animal kingdom superior to the vegetable, and proclaim man emperor of both. But time at last tells the real truth in that terse language whose vocabulary is made up in seconds, minutes, hours, days, weeks, months, years, decades, centuries, and eons. It is the constant and tireless vocation of all animal kind, from the lowest organism up to man, to tear down and destroy the forms of vegetation. The animal subsists and grows, during all its career, upon the destruction, consumption, and assimilation of some variety of vegetable life. The physical individualism of every man, woman, and child around us—in this world—was, not long since, animate in growing fields of grain, in gardens of succulent and nutritious root, and in orchards of brilliant and delicious fruit. Every muscle, fiber, and tissue in these hands, in your hands, was once animate in plant form and growth. So dependent is man upon plants, foliage, and fruit that the intermission of a single summer, the skipping of a single year of plant life, would turn from life into death every animal organism on the globe.

Each particle of vegetable growth is a part of the wonderful dynamic in the deft and occult chemistry of nature—a portion of the constantly absorbing, assimilating, transmuting, and transforming process, which molds into form, beauty, and utility the crude plant food of the earth, and colors and embellishes it with the prismatic glories of the sunlight. The vernal verdure of the opening buds, the luxuriant limning with crimson and scarlet of the flowers of May and June, the yellow gold of the harvest-fields in July, and the blazing colors of orchard fruits and gorgeous autumnal forests in October are only so much of rehabilitated animal life baptized and glorified by the light of the sun.

Plants, leaves, flowers, trees, catch and invisibly imprison in the cells of their growth light itself, and hold it captive for centuries. There is no light which did not originate in the sun. From the blaze of the taper to the flame of the furnace there emanates not a single ray which was not born in the solar system. The oil in the lamp gives up, after uncounted generations, the light which some sort of plant, some time in the misty past, during its period of animate growth, took captive by absorption from the sun. The roaring fires of red and glowing coals which warm us in the winter are merely the emancipators of sunbeams incarcerated ages upon ages ago, when those coals were parts of vast submarine meadows, or of gigantic primeval forests. And before they were either parts of sea-weed fields or of waving trees they were each and all portions of some kind of animal existence.

Had there been no decay and death ordained for man, no life could have been decreed for flowers and foliage, forests and orchards. Man and the beasts of the field destroy the forms of plant life, and seem, for the time, victors over the vegetable

kingdom. But the years and the centuries flow on, like a great and resistless river, sweeping into earthly sepulture all flesh and blood, generation after generation. Then the grass and the flowers send their tentacles, and the trees their rootlets, like detectives, with the keen and unerring instinct of nature's recouping laws, down into our very graves to repossess and reuse every jot and tittle of each organism, in rebuilding the kingdom whence it was ravaged. And giant trees stretching their limbs towards the clouds, their leaves shimmering in the sunlight, whispering and murmuring in the breeze, lure back, even from the atmosphere, the unseen and impalpable fluids which have exhaled from the dead and dying races of all animal forms, and again and again embody them in flowers, forests, and fruits. Ages come and go over this globe, as shadows and sorrows come and go over each individual life. The animal kingdom of this age was the vegetable kingdom of some age which has been. The physical men—all the animals—of to-day will be the plants, flowers, fruits, and forests in some age yet to come. These metamorphoses will succeed each other, with inexorable precision, as long as the sun shines and death remains, as now, the logical result of life. The cycles of transmutation from vegetable to animal life, and from animal back again to vegetable, will roll on forever with the seasons and the sun, inevitable as death, and wonderful in mystery as the depths of eternity itself. Nothing is, however, finally lost—nothing destroyed, for, in her most extravagantly luxuriant moods, Nature is frugal, and permits no waste. Forms change, forms disintegrate and disappear; but substance, both mental and material, is imperishable and lives on forever, defying decay and death with a conscious and ineffable immortality.

Each generation of humanity takes the habitable globe as its trustees to hold until, by order of the court of Death, their relations are dissolved, and the property turned over to their successors in trust. It is, therefore, the duty of each generation of trustees for this great estate of the family of man, and of all the animals, to take care that they pass the property over to their successors in trust in as good and tenantable condition as they took it from their predecessors.

And now, having shown how dependent is animal life upon contemporaneous plant life, we readily perceive that to leave the world in as good condition as we found it upon our entrance thereinto, we ought to bequeath to posterity as much of plant life, and as many forests and orchards, as we have exhausted and consumed.

During her two hundred years of active timber consuming what has Boston done towards reafforesting the country? Imagine some forceful magic which could at once replace in sylvan beauty every tree which Boston, in her sea-going vessels, in her marts of business, in her beautiful homes, has cut down and consumed during the two centuries of her active and successful career, and how grand a forest should be gilded by to-morrow's sun! And yet, with all her culture, her practical utilitarianism, and her philanthrophy, what has Boston, or all New England, accomplished, as trustee in charge of the woodlands, for its descendants?

It has aided largely and thriftily in constructing railways to the West, and through all meat and bread producing sections of the Union. One hundred and twenty-six thousand miles of railway are now resonant with commerce in the United States. Each mile contains 3,000 wooden ties—the average life of the tie is ten years; each year ten per cent. of the ties is renewed—at sixty cents apiece, the annual cost is more than twenty millions of dollars, and ten years from date every tie now in use will have been renewed. Think of the forests thus destroyed, and of the other means of consumption of timber products in bridges, cars, warehouses, depots, and fuel, which the voracious and insatiable railroads also employ, and do they replace any trees?

Not as yet. But the courts have declared the rights of the States to regulate railroads in many ways, and why not as to their utilization for tree planting along their lines on their one hundred feet of right of way? What objection can there be to compelling, either by national or State legislation, every railroad company in the Union to plant trees forty feet apart on the outer limits—either side of its tracks—of its right of way? And the law may prescribe that the trees planted shall be of useful varieties, adapted to the soil and climate which the road traverses. Why cannot this be accomplished? And is it not fair that these great consumers should be made also restorers of forests? Cannot this law be made justifiable on sanitary grounds, on the highest reason for all law, the public welfare—the greatest good to the greatest number? Having such a law faithfully administered for fifty years—even for half that period—and the tourist by rail shall journey from Georgia to Maine and from Boston to San Francisco between continuous avenues of elms and oaks, sheltered from summer dust and heat, and from winter snow and storm. Let us try it.

A painstaking statistician, from seemingly reliable data, declares that the fifty-five millions of Americans cut down and use up, in various ways of manufacture, railroad ties and fuel, each day in the year, an average of 25,000 acres of timber—of forests. Therefore, when we go to bed at night there are 25,000 acres less of woodlands in the

United States than there were when we got up in the morning. One month from to-day there will be, at the same rare of use, 750,000 acres less; and 1886—one year hence—there will be 9,000,000 acres less of forest lands than there are now. This plain statement of practical fact may startle into beneficial activity a class of men who, otherwise, would declare "Arbor Day" a merely sentimental anniversary, a useless holiday, and even deride its statutory legalization.

The denudation of woodlands proceeds with relentless and tireless energy in all the pine-bearing sections of the northwest. The ax of the woodsman and the puff of the steam-engine join, with the hissing of swiftly-revolving saws, in a death song for the fated forests, more foreboding of evil to our race than were those of the savage tribes who originally domiciled in their verdant fastnesses. The latter presaged only individual deaths; but the former portends floods and droughts, infertility, barrenness, and the extinction of entire communities.

Mr. Geo. W. Hotchkiss, secretary of the Chicago Lumberman's Exchange, a most reputable and entirely credible gentleman, officially declares that, during the six years ending January 1, 1885, the receipts of lumber at Chicago alone amounted to 10,728,941,322 feet. Computing that amount at common board measure it would closely, tightly, and completely cover, as a floor, with one inch thickness, 246,301 acres of land. Manufactured exclusively into fencing, it would circumference the globe with an enclosure five boards high, each board six inches wide, fifteen times. It would make a single line of such fence 677,332 miles in length. It would construct 225 just such fences from the Atlantic to the Pacific, reckoning the distance from ocean to ocean at 3,000 miles. Estimated at a value of 1½ cents per foot the same amount of lumber equals in cash $160,934,120. During the same six years ending January 1, 1885, there were 5,235,509 shingles also received in Chicago. At $2 a thousand their cash value reaches $10,471,531, allowing ten shingles to be used to cover a square foot. and they would roof more than 12,000 acres of land.

What is the lesson of present denudation? These figures, showing the enormous consumption of forest products, as indexed by the business of Chicago alone, are enough to incisively suggest the speedy total denudation of all the woodlands in America. Such startling statistics appeal to those who are exclusively devoted to vocations which use up timber and lumber directly, and address facts to those purely practical men who entertain no fancies, and regard life as merely a prose essay upon economic subjects. They go further; and to those who study climatology and sanitary conditions as affecting crop productions and human life, convey the importance of humane concerted action for the conservation of our woodlands and forests. They teach us all the imperative necessity of tree planting, and the retention of tree growth in every State of the American Union, for the welfare of our race.

But, to my mind, over and above mere dollar getting, higher even than mere physical health, stands the love of the beautiful in nature, beseeching us to plant trees, and renew dead landscapes with the shadow of plant life, flitting amidst the pendant limbs, the willowy boughs, and the waving foliage of sturdy woods. That is a wholesome and commendatory ambition which inspires one to endeavor to make the world better because he has been a dweller therein. And as our ancestors planted orchards to bear fruit for us, and embellished homes to shelter us, so should we, by the law of gratitude and compensation for these who come after—in the long procession of humanity, which laughs and weeps, and sings and sorrows, in that little journey from the cradle to the grave which we call life—leave similar *souvenirs* of our affectionate regard and solicitude. In some countries of Europe it is a family custom to plant a tree for every new-born child; and, in others, to set apart a few acres and devote them to trees, which, upon the infant becoming of age, shall be its heritage. Thus, the beautiful and the useful, the sentimental and the practical, are welded together in a good and vital deed. Thus, the tree planter of to-day "arborphones" his good wishes, his name, his character and taste to generations yet unborn.

And we are yet in the early days of forestry—in its January—and it is not too late, for all who will, to join the "Argonauts" and embark with us in pursuit of those golden fleeces of autumn-dyed foliage which shall clothe with undimmed lustre from year to year the grand forests with which the waste places are yet to be crowned and glorified. In no system of religion—in no form of belief—can be found a ceremonial which vitalizes faith as does the act of tree planting. Composing the roots and fibers in their soft and loamy bed, confident that each of the chemical agents of the earth will do its complete and perfect work of nourishment, and then looking upward to the sapphire sky, and the Source of All Light, with the serene certainty that the sun's rays shall warm and color into loveliness every leaflet, and that the mists and rain drops shall water and cleanse each from year to year, is an act of devotion to the Supreme Law, to Nature—the declaration of a sublime faith. It is faith expressed in a deed; and it is a deed which conveys health, happiness, and consolation to other generations besides our own.

In all the sacred books of all ages of civilization, the life for which man is constantly longing—the immortal, mental life beyond the grave—is portrayed as by still waters, and amidst all the luxuriant splendors of tropical woods and ever-blooming gardens, filled with the fragrance of exquisitely beautiful flowers. A monk of the seventeenth century has spoken of it as "a substantial world, where grass will grow, flowers will bloom, fruits will ripen, forests will wave, rivers and rivulets will roll, high hills will tower, valleys will wind, and vales expand, and beyond them all, as far as the eye can reach, vast blue oceans will forever heave and sigh and swell—where such as we shall go to enjoy the faculties we carry with us." The fact that, from its portrayal of the first home of our common parents amidst the pensive shades of the garden of Eden, up to its grandest and most realistic visions of heaven—in all its concepts of supreme satisfaction—the human mind has interwoven ideal happiness and consummate contentment with gardens and flowers, and forests and foliage, shows how the brain of man has always depended for its imagery and metaphor upon man's vegetable cotenants of the globe. This being the concept of consummate contentment in all ages, let us endeavor, then, by our works on "Arbor Day," and upon all opportune occasions, to so embellish this world with plant life, trees, flowers, and foliage that our temporary homes shall simulate in beauty that eternal home which the prophets, poets, and seers of all ages have depicted as a restful and refreshing paradise.

ADDRESS OF HON. GEO. B. LORING.

Dr. Loring commenced by referring to the peculiar and unusual position of forests and woodlands in this country as distinguished from the other countries of the world. The forests with their savage inhabitants were an obstacle in the way of advancing civilization and were the most discouraging difficulty which the early settlers were obliged to remove. The land was to them an untrodden wilderness, occupied by a gloomy and towering growth of trees—the "primeval forests," which have always conveyed the idea of untamed and often untamable nature. To substitute homesteads and cultivated fields for this wide-spread desolation was a work requiring great force, courage, and patience, and arrayed an enterprising and hardy people against the uncleared lands which lay all around them. The feelings engendered in those early days have hardly yet died out. The American people are tenacious of opinions, methods, and policy, and the warfare begun by their ancestors on the forests which stood in their way, and which have been violently removed to make room for the teeming towns and fair fields of a cultivated continent, has left an impression on the public mind which no theory of economy and no fear of loss have yet been able to remove entirely. To the careful and intelligent observer of our industries the value of our forest growth appears to be so great as to require the most careful legislation and the most thoroughly well-conducted private enterprise. But to the occupants of new lands, to the dwellers in those vast regions but just now occupied by an industrious people, this great timber growth presents itself as an antagonist to be speedily and ruthlessly removed, and as a people we have yet to learn that the wealth of wood with which our lands are clothed is entitled to the same care and protection as is bestowed on the cultivated crops, on our fields and orchards.

The organization of this Association, the constant search after judicious and applicable legislation, the introduction of forestry investigation into our educational institutions, the establishment of commissions to take charge of this great industry, all indicate the present estimate of the importance of forestry investigation, and the earnest, popular desire to restore and protect our timber land. The question is one of a purely practical character, and belongs to that class of economic subjects which occupy the minds of those who are interested in the growth and prosperity of our country. It is of the utmost importance that the business of forestry should be thoroughly understood. We would know how to use existing forests with economy and the largest profit to the owner. We would know the best methods of protecting the forests against natural decay, against accident and deliberate waste. We would know the best methods of encouraging nature in the work of renewing the forests, in which she is so busily engaged. We would know the best system of tree-planting—the trees best suited to each locality. We would know when and how to resign land once cultivated to the encroachments of the forest and what land to select for forest growths. The cultivation of a taste for ornamental tree-planting should never be neglected. The occupation of the Arbor-Day in many of our States, the work of the village improvement societies in all parts of our country, the study of landscape-gardening as a part of the necessary information of a tasteful community, deserve and

demand our most liberal encouragement. But, confident that this æsthetic work having been begun will never be neglected, we turn to that vast industry which within the last fifty years has risen into an importance not surpassed by our textile manufactures or our mechanic arts.

Notwithstanding the excessive forest supply with which this country was burthened in the early days, suggestions were made many years ago with regard to the protection of our woodlands, or "wood-lots," as they were called in New England, where every farm has this important attachment. As long ago as 1826 one of the brightest writers on agricultural topics in Massachusetts recommended very strongly the fencing of woodlands as a matter of economy. The question has now become broader, and, in a commercial point of view, much more important, including as it does not only the timber and lumber supply, but that vast consumption of wood in the manufacture of furniture, boxes, pegs, agricultural implements, vehicles of all kinds, pulp, and a long list of articles which enter into our domestic economy. The trade has an estimated value of $350,000,000 annually, in some of the States amounting to $40,000,000, and in the State of Maine, the pioneer in the business, to $7,000,000, notwithstanding the carelessness and waste which have attended the work for years.

It is fortunate, indeed, that while man has been reckless and extravagant in the development of the forest business to this important point, nature has been busy in restoring what he has destroyed. No sooner is a tree removed than the earth rallies to supply its place. The laws of creation seem to be opposed to an unoccupied piece of land; and there is no doubt that between the deserted farms of the older States and the newly-stripped forest lands which are engaged in producing a new growth of trees there is a larger supply of growing wood in New England and all the other States than there was fifty years ago. To him, however, who would secure from his waste lands a forest crop, as he would a hay or a corn crop from his cultivated acres, the choice of trees, the modes of planting, the best methods of handling are all important. The trees that grow most rapidly and vigorously are those which spring up spontaneously in some favorable spot from a chance-sown seed. Is it too much to say that a tree standing on the spot where it sprang up and where all its surroundings are genial—the spot where it sprang up, because it found every encouragement of soil and climate—will make more wood in ten years than its transplanted neighbor is likely to make in fifteen? Consider, then, the seeding of the forest as you would the seeding of the hay-field, and apply the same judgment in selecting the variety of seed for the one as you do for the other. If the choice is wise and appropriate, nature will do the rest of the work. That a tree crop is the most sensitive of all crops there can be no doubt. Corn can be made to grow on almost every variety of soil, and by artificial means can be made to yield a fair crop. Grass of some one variety will grow in almost every latitude. The crops of the garden flourish in Maine and Florida alike—each in its due season. But not so with trees. The pine will not flourish on every soil. The chestnut will withdraw from the seaside and find food for its rapid growth along the inland hillsides. The Norway spruce dislikes the hard, salt gales of the ocean shore. The monarch of the forest, standing on some favorable spot, towers above its fellows standing not far off, but dwarfed and stunted by the absence of that food which has fed the great proportions of the fortunate plant. How seldom do we see a forest of uniform growth—how seldom a nursery of forest trees presenting one type of size, shape, and thrift! Of a hundred trees transplanted we hardly expect to save more than two-thirds or three-quarters. Of a hundred cabbage-plants set out we expect to lose none. It is not easy to tell why one plantation of trees will make ten times as much wood in ten years as another plantation not many rods away. The sensitiveness of the tree makes its management most difficult—that sensitiveness which prevents its being planted indiscriminately with any hope of success. It should not be forgotten that nature is the best guide in the selection of varieties for each locality.

The natural renewal of forests, however, is one of the most interesting of all the important questions relating to this important subject. The spontaneous growth of the white pine on the sandy plains of the Northern States, the luxuriant up-springing groves of spruce which give such a vital beauty to the secluded swamps and hillsides of our extreme North, the rich verdure of the vigorous young chestnut forests, which adorn the inland hillsides—all bear witness to the diligence with which nature works in clothing the earth with its most attractive and useful product. To co-operate with this work of nature is certainly one of the most imperative of all agricultural duties—a duty which belongs to the individual and the State. In the older countries of Europe the value of the forest crop has been so thoroughly recognized that all the power of the State is exercised in preserving and developing it; and while the landowner is allowed to manage his annual crops in his own way, this growth of years is placed under the most careful and stringent protection of the laws. Alarmed by the waste of forest product and by the growing scarcity of timber, the most important of the European

States adopted long ago a system of forestry which has rescued them from the very danger which now threatens us. It was exactly the forest condition of America to-day which enlisted the most careful consideration of these continental governments. To restore this valuable possession private rights in land were extinguished, permanent forests were laid out and placed under the direct care of the Government, departments of forestry were organized, regulations with regard to cutting the timber were laid down, and every measure was adopted to increase the profit of lands devoted to timber-growth. The result has been all that was anticipated. And I can conceive of no more useful legislation than that which would enable every owner of timber-lands to realize that he is protected against all encroachments—that he is not exposed to the usual thoughtless causes of forest-fires—that his domain of forest is as well enclosed as his domain of corn—that his forest property belongs to an interest of which the State is particularly watchful, and that the development of his waste lands into woodlands will receive all the encouragement the State can bestow without creating invidious distinctions. Considering the amount of public and private timber-land in this country, and the foremost importance of this industry among all its industries, the Government should promptly enter upon a system of forest legislation which will protect all our national forest domain and encourage the landowner to enlist in this as he would in any other branch of agricultural industry.

The destruction of forests, to which our attention is now so earnestly called, and for the prevention of which State and National Legislatures are appealed to, and deliberative associations are liberally organized, has been an object of solicitude for a long time. We are in the habit of presenting a startling array of figures to show the rapid waste going on in this country at the present time, and to indicate what we may anticipate for the future, should this waste continue. To be told that, at the rate the cutting is now going on, even the spruce forests of New Hampshire and Vermont will be exhausted in a very few years, and that the pine forests of Maine will be destroyed in four years, and those of Wisconsin in twenty years, and those of Michigan in ten years, and those of Minnesota in ten years, is enough to startle the most indifferent observer of the industries and resources of our country. But this warning is not new or unusual. More than two hundred years ago it was predicted by one of the most eminent statesmen of France that the kingdom "would perish for want of wood." It took a century and a half to impress this fact upon the mind of France, and she was roused to action by the increasing destruction of her forests and by the disastrous consequences which ensued. Her necessities became great, and her exertions to remedy the evil were great in proportion. An appropriation amounting to $250,000 a year for ten years was provided by the government, and the work of restoration began with great energy. Along the banks of streams and on the borders of ravines trees were planted and protected, and a nucleus of forest growth formed which is now of inestimable value, and which, if commenced when the first warning was given, would have made France the richest forest-growing country of Europe both in quantity and quality.

This example of France should give us a warning and teach us a lesson. Not that this country is likely "to decay for want of wood," but the emergency seems to be fast approaching which will require remedies as heroic and expensive as those to which I have alluded. The efforts already made in this direction on a small scale have met with abundant success. Many a barren waste has been clothed with pines, and along the Western river valleys, formerly stripped, are now growing belts of trees increasing in extent as they are protected from prairie fires by advancing civilization, the natural forest-growth of the region. Here and there an illustration of the success which attends properly-managed seeding may be found. The well-known wooded hillside of Major Poore, from whom we have heard this evening, is too familiar to all interested in the cultivation of deciduous trees as a crop to require any additional description. The pine forest of Mr. Fay, at Falmouth, Mass., consisting now of nearly a hundred and fifty acres, is so successful an experiment in this kind of tree-planting that I venture to present it as stated by himself. He says that when he came into possession of the tract of land he has so successfully cultivated "it was a barren waste, the soil dry and worn out. On a hundred acres there was not a tree of any kind, unless an oak sprang out of the huckleberry bushes here and there, but hardly lifting its head above them. Indeed, when I bought my place in 1853, except a few stunted cedars on Parker's Point and in the swamps, there was not an evergreen tree within three miles of my house and hardly any tree of any kind in sight of it. It was maintained that trees could not be made to grow there. The seeds sown were of the native pitch-pine, with some white pine, the Austrian, Scotch, and Corsican pine, the Norway spruce, and the European larch, in all about thirty-five thousand imported plants and many thousand native pines. As to the kinds which have done the best the Scotch pine from the seed, including prompt germination, has proved the best grower and very hardy. The Norway spruce and English oak have done well. The larch did not

start well from the seed, but from the nursery or as imported it has grown remarkably. The hardy Scotch pine does finely, either from seed or the nursery. All these imported trees have done better than the native pitch-pine. The larches are about forty feet high and fourteen inches in diameter one foot from the ground. Some Scotch pines, from seed sown in 1861, well situated and in good soil, are thirty feet high and ten inches through a foot from the ground. As to profits one thing is sure, the land, originally poor, has been enriched by the deposit of thousands of loads of leaves upon it and by the shade afforded, while the soil has been lightened and lifted by the permeation of the roots of the trees, and though no present profit has been realized (which already might have been done by sales of the wood) it should be considered as an investment for future results. Considering the position of my place, on a coast exposed to violent sea winds permeated with salt spray, the vigorous growth and promising appearance of my forest plantations are very encouraging to those more favorably placed. Not only may the destruction of our forests be partially remedied at a cheap cost, but the waste and sterility of our land by long cultivating be replaced with fertility by the simple process of nature."

The planting of pines on Cape Cod has been pursued with great success, and the groves of Major S. B. Phinney, of Barnstable, are an admirable illustration of the beauty and profit of this branch of tree-culture.

When we remember the long-continued efforts in Europe and the smaller enterprise in this country to cultivate forest trees, almost all of which have been successful, it seems surprising that any argument should be necessary to prove the importance of this industry or to demonstrate its value as a profitable enterprise. We survey the apparently inexhaustible forests of the United States, and, notwithstanding the local destruction which is going on, we persuade ourselves that they will not fail to supply the increasing wants of our people. We rely largely on nature to restore the exhausted regions, and we turn to the vast wooded regions still untouched with confidence that they will respond liberally to every call. The temptations to the lumberman have been and are great; but there is no reason why the work of the lumberman should not be followed by a systematic, well-organized, and well-endowed effort to restore what he has destroyed.

In no better way could a portion of the idle capital of the country be employed than in the cultivation of forests on denuded lands. The returns may indeed be slow, but the investment is secure; and if Government is ever to stretch forth its hand for the encouragement of private enterprise it may with propriety assist and protect a work upon which so much industry, health, and comfort depend. The United States, of all nations, has almost alone neglected its forests. Great Britain has adopted measures to restore the forest-growth of India, whose mountain sides she stripped in her wars of conquest and in the industrial enterprises which followed. The forest system of Canada, on our very borders, is an example well worthy of study and imitation. Every country of continental Europe considers a forestry commission an important branch of government and every European people look upon schools of forestry as an important part of a system of popular education.

It must be evident to all that forestry legislation will be of no avail without forestry education. The protection of forests against destruction by cattle, against fires, against wasteful cutting, and the encouragement of tree-planting and forest cultivation by legislative enactments can only be properly carried out by the co-operation of skill and knowledge. It is only through a thorough understanding of the habits of trees and of the best modes of producing them and a full appreciation of the importance of a judicious selection for each locality that the true value of the forest industry can be acquired. A forester well equipped with the knowledge of physiological botany, of climatology, of entomology, so far as it relates to the protection of trees against destructive insects and of the foreign literature of the subject, might, if employed as a teacher in a conspicuous and influential industrial school, open the way to a systematic and intelligent organization, which would elevate forestry to the rank of the great industries of our country. As a guide to judicious and effective legislation and an instructor of the best practical methods, he might soon bring the laws of the land and the labor of the investigator and planter up to a standard of the best and most thoroughly organized forestry in the world, and place them beyond the reach of pseudo-science and imperfect legislation. Were every agricultural college endowed by Federal land grant supplied with a teacher of this description and an arboretum sufficient for his work the way would be opened to a great improvement in the business of tree-planting for use and ornament and to a system of State and national forestry which would commend itself to a practical business community.

It is to be regretted that the suggestions made in 1880 by a Committee of the American Association for the Advancement of Science have not been carried into effect. After stating that we are to look to the owners of land "for the adoption of measures

tending to avert the injuries in prospect" they urged upon the legislative bodies of the country the passage of laws protecting trees planted along highways, exempting from taxation the increased value of land from the planting of trees, endowing of Agricultural and Horticultural Societies to enable them to offer liberal premiums for forest culture and to publish prize essays on forestry, encouraging forestry education in schools and colleges, tending to prevent forest fires, establishing model plantations, and appointing commissioners of forestry. These measures would lay the foundation of a forestry system in this country which would render forest property comparatively secure and would put an end to the wasteful and destructive use of standing wood and timber now existing throughout the country.

The discussion of all questions relating to forestry has been so long and so elaborately continued in this country that hardly a point remains unexplored. Of the importance of preserving and restoring the forests no one now entertains a doubt. Their value, in an economic view, is perfectly apparent. It is generally accepted that they have a great influence on the climate—the heat and cold, the droughts and rainfall—of every country. Their contribution to the mechanic arts and to the implements and utensils of life is great and important. That their management should be systematic and business-like is everywhere recognized; and yet there is no property in this country in such doubtful condition. In one section the forest product is hastily crowded into the market in order "to escape the taxation" levied on woodland and in order to "realize" upon it as promptly as possible. In another section no market exists for most valuable timber lands on account of unorganized lumber industry and absence of convenient transportation. In another section thrifty growing forests are cut down to supply a cheap and common article of trade—forests which by their growth alone would earn large interest upon their money value. The axe and fire continue their desolating work. True ornamental tree-planting increases everywhere. Trees along village streets, trees along highways, trees along our city avenues, trees in parks, and groves on estates increase and flourish under man's care and protection. Arbor days have in many States become legalized holidays. And so far as taste and sentiment are concerned the tree receives its full appreciation. But it cannot be said that either on our national domain or on State reservations or on private lands do our forests receive that systematic care to which they are entitled. The application of laws long since adopted in other countries seems to be impossible in our own. Institutions devoted to education in forestry have not yet been transplanted from the old world to the new. The system under which the public lands of the United States have been managed has thus far admitted no measures of economy with regard to the various resources of those lands in mineral agriculture or forestry wealth. The tenure of land in the States hardly allows statute interference with the methods by which it is managed, and the difficulties which lie in the way of an organized forest economy, State and national, are not easily removed. We have computed to a fraction the amount of wood consumed in railroad sleepers, in shoe pegs and pill boxes, and machinery and implements, and building materials annually, and how much oak and hemlock bark is required to supply our tan-yards; but how best to obtain and care for and increase the supply of raw material we have not yet ascertained. It is interesting to contemplate the efforts which have been made in this direction. Our attention is called to proposed systems of management of "forest lands in mountain regions," to "proposed reservations of timber land," to the "different modes of payment for privileges," to "timber management in Canada," to the advantages of "experiment stations," to the "prevention of forest fires" by legislation. It is provided by law that any railroad company shall be liable for damage by fires along its line, but "said company shall not be held so liable" if it can prove that its fire-boxes, smoke-stacks, &c., are in good order. It is also provided in the same statute book that a justice of the peace shall call out the people to extinguish field and forest fires, and said people shall be fined if they fail to obey. It is provided by law also that no person shall "willingly, intentionally, negligently, or carelessly" set fire to woods under a penalty of from five to a hundred dollars, unless he shall have given his neighbors one day's notice of his intention to start a fire on his own premises. By law we are warned not to set fires, but we are not prevented from setting fires on wild and unappropriated lands between the first of February and the first of May, "or from setting on fire rubbish, leaves, or brush on the farm or plantation of any person or persons as often as occasion may require, if the same be done without the intention of setting on fire the adjacent woods, marshes, or prairies not owned, possessed, or occupied by such person." The "meshes of the law" are so large in legislation like this that any offender can easily escape, and this is an illustration of the difficulties under which we labor in all directions.

Nothing can provide a remedy for these evils and difficulties, both in practice and in law, but an enlightened and determined public opinion. That this country is entitled to all the benefits to be derived from forestry legislation and forestry manage-

ment no one can doubt. True, the power of private interests may ultimately develop all necessary remedies for existing evils, but behind and attendant upon these private interests must go a popular understanding of the importance of the questions involved and a consequent popular readiness to support measures necessary to accomplish the desired object. For the education of the popular mind to this standard all the efforts of colleges, schools, scientific investigators, and associations should be encouraged in their work. In this direction the American Forestry Congress may well continue the valuable work upon which they are engaged.

THE STATE OF LEGISLATION IN REGARD TO FORESTS.

BY N. H. EGLESTON.

Legislation in respect to forests takes the two general forms of laws for the protection and preservation of existing forests and laws to encourage the planting of new ones. By far the greater amount of legislation is of the former kind, it being only within a few years that any noticeable provision of law has been made to promote the planting and cultivation of new forest areas.

It is remarkable also, that almost from the beginning of our history as a nation there was more or less anxiety on account of the early inroads made upon the timber. Among the earliest enactments of the Colonies, particularly the northern ones, we find some designed for the preservation of the trees, and there are records of numerous votes of towns for the same purpose. For instance, the Provincial Assembly of New Hampshire, as early as 1708, forbade the cutting of mast-trees on ungranted lands under a penalty of £100 sterling. The Province had at that early time also a surveyor-general of forests, appointed by royal authority, for the purpose of preventing depredations upon timber. The office was held at one time by Benning Wentworth, subsequently the well-known Governor of the Province. In 1640, only two years after its settlement, the inhabitants of Exeter adopted a general order for the regulation of the cutting of oak timber. Other towns manifested a like concern for the preservation of their forests, and adopted similar measures.

In Pennsylvania, well wooded as its very name assures us it was at the time of its settlement, and well wooded as it still is, ranking as the third State of the Union in the amount of lumber which it produces, in an instrument entitled "Conditions and concessions agreed upon by William Penn, Proprietary and Governor of the Province, and those who are the adventurers and purchasers in the said Province," dated July 11, 1681, and intended as a charter of rights to the colonists, the following provision was made in reference to the maintenance of the timber supply:

"XVIII. That in clearing the ground care be taken to leave one acre of trees for every five acres cleared, especially to preserve oak and mulberries for silk and shipping."

In Massachusetts a similar care for the trees was manifested, and towns, as well as the General Court, took action for their protection.

As the early action for the protection of trees, by the Colonies and by individual towns under the colonial government, was caused principally by the apprehension of a scarcity of timber for marine and naval construction, so the same apprehension, after the country had passed out of the colonial condition, led to the adoption of measures by the Federal Government for the protection of such trees especially as were most desirable for ship building. The well-known scarcity of such timber in Europe led to the fear that the countries across the Atlantic would make such large demands upon the forests here as would render it difficult to procure an adequate supply for our own wants. Accordingly, it was only a few years after the action of the Federal Government, in 1794, authorizing the construction of four ships of forty-four guns and two of thirty-six guns, for the protection of American commerce against the Algerines, that a vote was passed appropriating $200,000 for the purchase of growing or other timber, or of lands on which timber is growing, suitable for the Navy, and for its preservation for future use.

Florida and the Gulf coast, where grew that specially valuable tree for ship-building, the live oak, did not belong to us at this time, and the amount of that timber growing within the limits of the Union was comparatively small. Some purchases were made along the coast of Georgia under the act of 1799, but nothing more was done by the General Government for the preservation of timber until the year 1817, when an act was passed directing the reservation of such public lands having a growth of live oak or cedar suitable for the use of the Navy as might be selected by the President. Under

that act commissioners were appointed, and two islands on the coast of Louisiana, containing about 20,000 acres, and supposed to have growing upon them 37,000 live-oak trees, were reserved for the use of the Government. Ten years later, it having been found that an extensive exportation of live oak, averaging one hundred and fifty cargoes annually, had been going on for several years, the sum of $10,000 was granted for the purpose of purchasing live oak and other timber lands for the Navy, and a tract on Santa Rosa Sound was purchased, and for a time considerable was done in the way of planting and cultivating the live oak.

By another act—that of March 3d, 1827—the President was authorized to take proper measures to preserve the live-oak timber growing on the lands of the United States, and to reserve such lands in sufficient quantitities to render the same valuable for naval purposes.

By an act of March 2d, 1831, provision was made for the punishment of persons for cutting or destroying any live oak, red cedar, or other trees growing on any lands of the United States, by a fine of not less than three times the value of the timber cut and imprisonment not exceeding twelve months.

Under the act of 1817 and subsequent acts there have been reserved in Florida, Alabama, Mississippi, and Louisiana about 250,000 acres of timber land.

Aside from these reservations of timber for naval purposes, no action has been taken for the preservation of timber until quite recently, when the Yellowstone Park was made a reservation. With this exception the Government has been strangely neglectful of the timber land in its possession. It has scarcely given sufficient attention to it to ascertain its location with definiteness or the character and value of the trees growing upon it. It has allowed trees to be cut and burned almost with impunity. It has made enactments, indeed, forbidding the destruction or theft of its timber, but has adopted such feeble and irresolute measures to enforce its laws that they have had little practical efficacy. At the present time the timber on the public domain is being plundered both by individuals and corporations, and hardly any check is put upon it.

Of the several States, in distinction from the General Government, it may be said that all of them have recognized the forests as having some value as property and have protected them on this account to a certain extent. Most, if not all of them, have made enactments against the cutting or injuring of timber growing upon the land of another or belonging to the State. But in making these enactments they have estimated the trees only according to their value for lumber or firewood, except the comparatively few planted along the roadsides or in parks and other public inclosures for purposes of shade and ornament. In these instances a somewhat higher value has been assigned and a heavier penalty decreed for their destruction. In all the legislation that has taken place in regard to forests, however, it may be said there has been no recognition of their importance from a sanitary or climatic point of view—their influence upon the distribution of moisture, upon the growth of crops, or upon the flow of streams and the consequent effect upon commerce and manufactures. Only in the lowest view of their importance have the forests been taken into account or efforts made for their protection and preservation. This is the general fact.

In all the States and Territories, and from an early date in their history, there have been laws designed to prevent injuries resulting from forest fires. Injuries from this cause have been so great at times, and are so constantly threatened, that protection from them becomes one of the earliest subjects to receive attention and to gain the aid of legal enactments. As might be expected, there is a general similarity in the laws enacted on this subject. The willful setting on fire the woods of another commonly exposes the offender to a fine or imprisoment, and in some cases to both, while it also renders him liable for all damage that his act may occasion. As willfulness can be proved, however, only in rare cases, laws of this class are operative, if at all, by their threat rather than their execution.

Another class of laws are those which inflict a penalty upon persons who set fire upon their own premises and allow it to extend to the premises of another. Such persons are usually made liable for all damages thus occasioned, unless they use all means in their power to prevent the extension of the fire beyond their own grounds, and, in some cases, unless they give notice beforehand to adjacent proprietors of their intention to kindle the fire. Persons are also made liable for the acts of their servants in this respect and to pay damages which they may occasion, and the servants themselves are also made liable to punishment. In some cases constables or other officers are authorized or required to call upon citizens to aid in extinguishing forest fires, and persons so called upon are liable to a fine if they refuse to give their aid. In some cases double damages may be claimed. Whipping has also been inflicted by many States in the case of servants or others unable or refusing to pay fines.

From the earliest period to the present the laws for the protection of forests from fires have been modified more or less with the purpose of making them more effective,

but the general testimony is that they have had but little efficacy. The forests are consumed now as frequently and extensively as ever. One reason of this is to be found in the difficulty of proving either malice or criminal neglect or carelessness. But another reason is the inadequate sense of the value of the forests and of the great loss involved in their destruction which is possessed by the mass of the community. The laws will be inefficient until the public sentiment in regard to the forests is changed. When old and young, educated and uneducated, understand and feel that the trees have a value for something else than as lumber or fuel; that they have a close connection with human welfare, with the health and comfort of man and beast, and are among the most precious possessions we have, then, and not till then, will forest fires be suppressed or kept within such narrow limits and made so infrequent that they will not be a serious concern to us. Then the school-boy, the sportsman, the poorest day laborer, will all alike look upon the trees with friendly interest and be their protectors, even without the incitement of law and penalty.

If we turn now from what has been done for the protection and preservation of the forests to what has been done to extend the wooded area by planting new ones, we shall find it but little and of recent date. While the desirableness of planting trees may have been felt here and there from a very early period, especially where trees have been somewhat deficient, or for the sake of securing new varieties, the first recommendation of tree-planting by any society or public body of men, so far as I am aware, was made in 1791 by the New York Society for the Promotion of Agriculture, Arts, and Manufactures. A committee was appointed for the purpose of considering the best mode of preserving and increasing the growth of wood and valuable timber. The committee reported in favor of devoting the lands least valuable for agriculture to the growth of trees, and that they should be stocked for this purpose. They insisted upon the importance of fencing out cattle, and, in short, advanced opinions and made recommendations on the subject which show a very enlightened understanding of it, quite in accordance with much of the best judgment and knowledge of our own times. If the recommendations of this society had been, to any considerable extent, adopted and carried out in corresponding action, the result would have been a great addition to the wealth of the State. By an act of the Legislature of New York, passed in 1869, tree planting is encouraged by allowing the overseers of highways to abate from the highway taxes of any land-owner the sum of $1 for every four trees set out along the highway opposite his land, the abatement, however, not to exceed in any year more than one-quarter of the highway tax. In the present year the Legislature has appointed a Forest Commission, to which are given extensive powers of control over the public lands of the State. Provision is made for introducing instruction in forestry in the schools and for publishing tracts and circulars on trees and tree-planting. More effective laws have been made also for the protection of forests from fire.

Colorado is in advance of all other States in having a constitutional provision in behalf of the forests. The eighteenth article of her constitution provides that "The General Assembly shall enact laws in order to prevent the destruction of and to keep in good preservation the forests upon the lands of the State or upon the lands of the public domain, the control of which shall be conferred by Congress upon the State." The appointment of a Forest Commissioner this year was the first decisive action taken in compliance with this mandatory provision of the constitution. The Forest Commissioner has the care of all woodlands owned or controlled by the State. He is to make rules and regulations for the prevention of trespass upon such lands, for the prevention and extinguishment of fires, and the conservation of forest growth. He is also, so far as possible, to promote the extension of the forest area, encourage the planting of trees, and preserve the sources of water-supply. The County Commissioners are also enjoined to encourage the planting of trees along water-courses and irrigating ditches and in other proper places. By other acts persons are made liable in triple damages for any injury to the trees of another, whether on enclosed lands or on the highway. The increased value of land, occasioned by planting fruit or forest trees upon it, is not to be assessed for the period of ten years after the trees are planted. A premium is also offered, for six consecutive years, for every one hundred forest trees planted along irrigating ditches.

In California the Board of Supervisors of any county of the State are empowered to authorize the planting of shade and fruit trees along the public roads by persons owning the adjacent lands, and persons planting such trees, according to the regulations of the Board, are entitled to one dollar for each tree so planted and growing thriftily four years after the time of planting.

In Connecticut a law was passed in 1877 to encourage tree-planting. It was provided by this act that planted woodlands which, at the time of planting, were not worth more than fifteen dollars an acre should be exempt from taxation for ten years. By an act of 1881 a bounty was offered for planting trees on the highways.

In the so-called Prairie States, lacking trees to a great extent at the time of their settlement, the people became tree-planters almost from necessity, and those States have been among the earliest to encourage tree-planting by offering bounties directly, or by the exemption from taxation for a certain number of years of land devoted to trees. They have been the first also to adopt Arbor Day and to prove its efficacy.

More than ten years ago (1874) Illinois passed a law for the encouragement of the planting and growing of timber, by allowing the Board of Supervisors or the County Commissioners' court in any county to offer a bounty, to any person who should plant one or more acres of forest trees and properly cultivate the same for three years, of a sum not exceeding ten dollars per annum for three years for each acre so planted.

Iowa in 1868 passed an act exempting from taxation the real and personal property of each tax-payer, who should plant and suitably cultivate one or more acres of forest trees for timber, to the amount of $100 for ten years for each acre so planted and cultivated.

Kansas in 1868 passed a similar law, offering a bounty of two dollars for every acre of prairie land that might be planted, within ten years, with any kind of forest trees, excepting black locust, and successfully grown and cultivated for three years. A like bounty was offered for each half mile of trees planted along any highway and cultivated and protected for three years. The bounty was to continue twenty-five years if the plantation was continued in growing condition so long. This act was subsequently repealed, not because the people of Kansas did not continue to favor the planting of trees, but because the further offering of bounties was not needful.

The Legislature of Nebraska in 1869 provided an exemption of $100 a year for five years on every acre of trees planted and suitably cultivated. The constitution subsequently adopted forbade the exemption of private property from taxation, but made it allowable that the increase in value of land, by reason of its being planted with trees or live fences, should not be taken into account in the assessment of the same. Towns are required to plant shade-trees, and taxes are levied on this account. Arbor Day, which originated in this State, has been heartily adopted by it, and more than 500,000 acres of planted forests are now beautifying and enriching the plains of Nebraska.

In Missouri, by an act of 1870, every person planting one acre or more of prairie land, within ten years from the passage of the act, with any kind of forest trees except black locust, and successfully growing and cultivating the same three years, and every person planting, protecting, and cultivating for three years one-quarter of a mile or more of forest trees upon his own land, to be set not more than one rod apart and to stand at the end of three years not more than two rods apart, shall be entitled to receive for fifteen years an annual bounty of two dollars per acre and two dollars for each quarter of a mile so planted. This act was amended in 1876 by extending the time to ten years from that date as the limit within which planting might be begun.

Michigan, which is cutting off her rich growth of forest with fearful rapidity, has done nothing to replace the trees removed. She has, however, encouraged the planting of trees along the roadside by allowing any one to pay twenty-five per cent. of his highway tax by planting trees on the margin of the road adjacent to his own land. By an act of 1881 any one injuring such trees is made liable to an action for damages from $1 to $25 for each offense.

In 1871 Minnesota passed "an act to encourage the planting and growing of timber and shade trees." This has been modified and amended at various times since. It provides that every one planting and cultivating from one to ten acres of forest trees for six years, and every one planting and keeping in growing condition half a mile or more of trees along the highway, shall be entitled to three dollars annually for each acre and two dollars for each half mile of such line of trees for six years. This State has also appropriated $5,000 to its State Forestry Association, to enable it to publish a manual of tree-planting and to secure lectures and experimental cultivation of trees, to distribute trees and tree seeds, to give information as to the best method of preventing forest fires, &c.

Nevada, ranking among the lowest of our States in respect to timber supply, and rapidly wasting that supply, has passed an act similar to that of Minnesota for the encouragement of tree-planting. Every person planting one acre or more of land, within ten years after the passage of the act in 1877, with any kind of forest or shade trees, and cultivating the same for three years, and planting and cultivating for the same time one-half mile or more of trees along the highway, is entitled to receive for twenty years, commencing two years after the trees are planted, an annual bounty of ten dollars per acre and ten dollars for each half mile so planted. The taxable value of the land is not to be increased by such planting, and stringent penalties are provided to protect the trees from injury.

Maine, the Pine Tree State, has been one of the first of our States to legislate for the preservation and extension of forests. In 1872 the Legislature enacted a law, pro-

viding that any landholder who should plant or set apart any cleared lands for the growth and protection of forest trees, within ten years after the passage of the act, and cultivate the same for three years, the trees being not less than two thousand to the acre, the lands so planted should be exempt from taxation for twenty years. The act also encouraged the planting of trees along highways by a similar exemption from taxes, and provided proper penalties for the removal or injury of trees thus planted.

The general statutes of Massachusetts prescribe that the Agricultural Societies receiving the bounty of the State shall offer premiums, at their discretion, for the raising and preserving of oaks and other trees best adapted to perpetuate a supply of ship timbers. They also encourage the formation of societies for the purpose of improving streets and public squares by planting ornamental trees thereon. Massachusetts was the first State in the Union to institute a special survey of its forest resources. This was in 1837, and the Report of Mr. Geo. B. Emerson on the Trees and Shrubs of Massachusetts, in two volumes, is not only an honor to the State but a treasury of information in regard to a large portion of the trees with which our country abounds. The subject of forestry has been discussed by the Agricultural Societies and the public journals more amply and for a longer time, perhaps, than in any other State, as a result of which, or at least coincident with which, numerous tracts of land, especially in the eastern portion of the State, have been planted with forest trees and are to-day the most conspicuous instances of successful forest-tree planting to be found in the country. As long ago as 1804 the State Society for Promoting Agriculture offered, among other prizes, one "To the person who shall produce from seed the best growth of trees, not less than 600 in the whole, and in the proportion of 2,400 to the acree, of any of the following kinds of forest trees, viz: Oak, ash, elm, sugar-maple, beech, black or yellow birch, chestnut, walnut, or hickory, $25; if all of oak, $50. In 1876 this Society offered premiums, ranging in amount from $400 to $1,000, for the best plantations on poor or worn-out land, not less than five acres in extent, of European larch, Scotch pine, and Corsican fir. Prizes were also offered for plantations of the white ash. In 1882 the State passed an act authorizing towns and cities to provide for the preservation and reproduction of forests. They may take or purchase any land and make public domain of it. The title of all such land vests in the Commonwealth, and is to be held in perpetuity for the benefit of the town. The State Board of Agriculture is also to act as a Board of Forestry and have the supervision and management of all such public domains.

New Hampshire in 1881 appointed a Board of Commissioners to inquire as to the extent of the destruction of the forests, the effect of forests on rainfall and the condition of streams, and in regard to the wisdom or necessity of forest laws. The Commissioners have attended to their duties faithfully and have made an extended report of the result of their inquiries. They deplore the rapid and inconsiderate manner in which the forests have been destroyed and urge the adoption of effective measures to secure the preservation of what remain and their proper management. They set forth the fact that the mountainous character of the State adapts it especially to the growth o trees rather than of agricultural crops, and that the most profitable use of a large part of the land in New Hampshire will be found in devoting it to the cultivation of forests. No action has been taken in regard to this report, but by existing law towns may raise money to set out shade trees and abate taxes to persons who do so.

Ohio established in 1882 an Agricultural Experimental Station, part of the operations of which are to be the planting and testing of trees in an arboretum and the encouragement of tree-planting throughout the State. Later a Forestry Bureau has been created in connection with the State University at Columbus. This bureau is engaged in establishing forestry experiment stations.

Vermont is similarly situated to New Hampshire, and takes her name from her green, forest-covered mountain ranges. She has more land of an arable character than her neighbor State, and a considerable portion of her surface is adapted to the purpose of grazing, but the cultivation of her crops and of her flocks will be most successful only as her forests are cherished and protected. In 1882 commissioners were appointed "to inquire into the subject of the forests of Vermont as to their extent and condition, and what, if any, measures should be taken in respect to their preservation." The committee made a carefully-prepared and instructive report to the Legislature in October of last year, recommending certain enactments for the better protection of the forests, but no action has yet been taken by the Legislature.

It is not necessary to make mention further and specifically of the existing condition of forest legislation in the several States. In most of the older States, especially those of the North, there has arisen within a few years past a sense of the value of forests for something besides their lumber products, and some measures have been taken to guard the existing forests from too rapid destruction and to encourage forest-planting. The Southern States, most of them being heavily wooded and with less

demand made upon their forests than has been made upon those at the North for lumber products, have not felt as yet the necessity of planting trees, and their legislation has been limited, for the most part, to guarding the existing woodlands against the ravages of fire and from the plundering of thieves. The newer States, many of them comparatively treeless, have been the most forward to promote forest-tree planting. This they have done by offering liberal premiums—by exemption of planted forests from taxation for a term of years and by the adoption of Arbor Day, which from year to year appeals to all the people of the State to unite in the simultaneous work of tree-planting.

The condition of legislation on the part of the General Government in distinction from that of the individual States may be given in few words. We have seen already that in the early years of our history measures were taken by the Government to protect such timber as was suitable for the construction of naval vessels, and to acquire a larger supply than it then had, by purchasing certain islands and land upon the seacoast where such timber was to be found. In recent years the Government has made various enactments for the purpose of preventing depredations upon its timber lands by thieves. These enactments have been suitable to the case, but, like other enactments, they will not execute themselves or inflict the proper penalty upon evil-doers, and the appropriations made by Congress for the purpose of guarding the public forests, or bringing the depredators upon them to conviction and punishment and recovering the stolen property, have been quite inadequate, and so the plundering goes on to the extent of millions annually in value.

The Government has also sought to promote the planting of new forests by means of the Timber-culture Act, in itself most commendable and promising great benefit to the country, but which has been so often evaded, with the result of the acquisition of land without cost and under false pretenses, that many are of the opinion that the act should be repealed.

Largely through the efforts of a recently-deceased member of this congress and one of its officers, the attention of the National Congress has been directed, within a few years past, to the general subject of forestry, and an inquiry has been set on foot, in connection with the Department of Agriculture, in regard to the existing condition of the forests of the United States; the annual amount of consumption, importation, and exportation of timber and other forest products; the probable supply for future wants; the means best adapted to the preservation and renewal of forests; the influence of forests upon climate, and the measures that have been successfully applied in various countries for the preservation and restoration or planting of forests. A Forestry Division of the Department of Agriculture has been created for the purpose of prosecuting these inquiries, and four volumes of reports from this Division have been published, embodying a large mass of information in regard to the subjects embraced in the scope of its inquiries. It may be said without hesitation that nowhere else within an equal compass is there to be found in the English language such an amount of information in regard to the subject of forestry. Facts of the utmost importance have thus been brought within the reach of the people, and if appropriate action is taken by them it will be of immeasurable value to the country, evils and disasters which have fallen upon other countries as the result of the loss of their forests may be avoided by us, and the trees may be converted into the most important means of our continued prosperity.

WHAT ARE THE ESSENTIAL FEATURES OF AN EFFICIENT FOREST-FIRE LEGISLATION?

BY S. W. POWELL.

In the nature of the case answers to this question can be definite and specific only upon the negative side. There *has been* sufficient experiment to ascertain some features which are not desirable. We know several things that *will not* work, but do not, as yet, know exactly what *will* work. The object of this paper is merely to indicate, upon the positive side, some of the general features or characteristics of any successful legislation designed to prevent forest fires or, when they do occur, to limit their *range* as much as possible.

The first point that suggests itself is this: Such legislation must be framed with a proper understanding of its *importance*. As we are not now considering the need of such legislation—a large subject in itself– it will serve the present purpose merely to allude to the fact that the direct damage done by forest fires is probably not less than three hundred million dollars a year, and that the indirect damage in the way of denuding steep slopes and sending the ashes resulting from burning the soil, and what grew out

of it, down stream, to the lasting detriment of navigation and manufactures, and also in the way of discouraging efforts to plant new and develop old woodland, is, in the long run, perhaps as great as the direct, or even greater. Only those who have some proper notion of the size and power of an enemy can plan a successful campaign against it; and right here comes in the importance of such statistics as only the General and State Governments can collect. Much has been done, but those who know most of what has been accomplished are the most desirous of something far more complete.

In the second place such legislation should not be so far in advance of public sentiment as to produce reaction. While those who draft the laws should know the importance of what they are after, they should have balance enough to recognize the fact that enactments that are not enforced—especially when the failure results from the apathy or the opposition of the public—generally weaken rather than help a cause.

Again, these laws should discriminate between localities where the damage is mainly direct and immediate and those in which it is remote and cumulative. *E. g.*, in the level coast-pine regions of Georgia and the Carolinas the damage done by fires is measured mainly by the value of the timber and forest products consumed, and by the injury done to the soil by burning up its vegetable substance and the tree-seeds it contained. In the Adirondacks, on the contrary, the loss is likely to be indirect for the most part. The damage to the Hudson, the Mohawk, the Erie Canal, and to hundreds of small streams which will be capricious and irregular in their flow, and to the great and rapidly increasing interests connected with summer travel, and besides all this, the permanent injury done to the climate of Eastern New York—all these are likely to vastly outweigh the direct value of the timber burnt, or of that which would afterwards grow upon those steep slopes. Once change the Upper Hudson to a torrent and no one can measure the harm that it will occasion.

Another feature of such laws is that while making free use of the experience of other countries where forest administration—both public and private—is so much more developed than in America, they should not attempt to adopt foreign systems without the modifications rendered necessary by the different conditions of climate, density of population, price of forest products, cost of labor, and habits of thought.

Again such legislation should be devised and often largely administered and supervised by Commissioners or special officers who give their entire time to the necessary experiments and investigations, and those who are charged with these duties should be so appointed and the tenure of their office should be such, that they will be entirely above the influences of partisan politics.

Another important feature in such legislation is this: it should distinguish everywhere between enforced and aided fire-prevention, as the French Reboisement Law of 1860 did between enforced and aided reboisements. In some cases proprietors may have so much at stake, may be so intelligent and be possessed of such resources, that all they need will be help. The administration and enforcement of the laws can in such cases be largely entrusted to them. *E. g.*, in the Adirondacks the business of entertaining summer travelers and serving them may become so lucrative and at the same time be so put in jeopardy by fires, that the hotel keepers and guides will need nothing but the authority afforded by suitable laws, to prevent or arrest fires. The same may become true of more thickly settled regions. In them farmers may come to appreciate the advantages of timber culture and the extent to which forest fires hinder success in it. In such cases nothing will be needed but enactments which such communities can mostly enforce and administer through the ordinary courts and officers.

In other regions the immediate and direct damage likely to be done by fires may be slight as compared with those which are indirect and consequential, while at the same time the local proprietors may be few in number, poor, and unintelligent. In such localities the State or even the National Governments may fitly charge themselves with the execution of the necessary preventive measures. Such a case may arise upon the headwaters of the streams tributary to the Ohio. Residents of Western Pennsylvania, West Virginia, Tennessee, Kentucky, as well as those of Ohio, Indiana, and Illinois, may be chargeable with acts and neglects which occasioned, or at least aggravated, the floods of 1882–'83–'84. In many cases these residents may be scattered over wide areas, few in any one locality, and at the same time be poor, ignorant, and lawless. It would be folly to expect them to appreciate the importance of cutting timber and preventing fires in such a way as to minimize the likelihood of floods, whose chief damage would be done hundreds of miles down-stream. The State governments might not feel able or willing to expend the sums necessary to instruct and restrain these people and to induce them to co-operate with, rather than to oppose, the needed regulations, and yet it might be a grand economy for the National Government, with the cordial consent of the States concerned, to charge itself with the needed outlay of money and labor.

It may be in time that, with the consent of the Northwestern States, the General Government will carry out a system of forest administration that will make it reasonably certain that fires shall not rage in the woodlands covering the mountains, hills, and bluffs of the regions drained by the Upper Mississippi and Missouri rivers.

Another example of aided prevention has reference to the vexed question of leaving the tops of trees and the other *débris* of logging to feed—and, indeed, invite—forest fires. Among the lumbermen themselves there are two opinions. Some advocate—and upon their own lands practice—such a disposal of this rubbish that fires are not the almost inevitable sequel of logging. The *Northwestern Lumberman*—which, however, is not always consistent with itself—has warmly advocated the enforcement of such treatment of this stuff. Now the time may come when conservative lumbermen will be glad to have the power to compel their more reckless associates to do what the common good demands. In such case it is clear that the wisest thing might be to pass a law merely aiding and enabling the prudent to restrain the reckless.

But I will go no further with these general statements. As to specific details they must vary so much with change of conditions that to prescribe them here and now would savor of quackery.

LETTER FROM H. C. PUTNAM, ESQ., OF EAU CLAIRE, WISCONSIN.

Mr. Putnam, being detained in London and so prevented from attending our meeting, as he expected to do, wrote at the last moment to express his keen regret and to testify his great interest in the object and work of the Congress. He gives an interesting account of what he had seen during the summer, in a quite extensive tour among the forests of France and Germany. He was especially impressed by the care with which diseased and wind-fallen trees were removed and their places filled by young and vigorous ones. In the little province of Baden, which is about as large as a medium-sized county in Wisconsin, he found one hundred carefully-trained foresters. High upon the mountains, in almost inaccessible places, trees that were blown down were cut and saved. He thought that great emphasis should be given to the fact that all over the continent of Europe rainfall and other climatic conditions are much more favorable to tree-culture than they are in our own country, and besides, stone, brick-clay, and other building materials are much more plentiful than in most of our prairie States. In Europe also, most of the buildings needed are already in existence. Yet they seem much more desirous to avoid extreme denudation than we do, who have an immense and rapidly-filling treeless region, while the stores upon which it must depend are swiftly vanishing before the reckless destruction of our white pine. We may, and should, cut the merchantable pine, but should take care to preserve an ample area of forest for a future supply. The most important means to this end, he thought, is the careful removal of the débris of logging, since white-pine land, especially when once burnt over, will produce nothing but deciduous trees for a long time afterwards.

In conclusion, Mr. Putnam urged thorough organization for work, to secure needed legislation and to arouse and direct public sentiment. We may, said he, meet to read papers and pass resolutions for a thousand years, but unless we do something more definite we do not make progress.

SMOKE-CONSUMING DEVICES FOR LOCOMOTIVES.

BY J. N. LAUDER, SUPERINTENDENT OF MOTIVE POWER, OLD COLONY RAILROAD.

In presenting this paper on smoke-consuming devices for locomotives it is not my purpose to enter into the details of the mechanical construction of the various devices that have been experimented with in a practical way during the last thirty years, or, to speak more accurately, ever since the locomotive was brought into existence, but to give, in a general way, what has been done in the past and what is being done at the present time to mitigate the evils of the discharge of unconsumed products of combustion from the chimney of the locomotive.

The smoke and sparks that are discharged from the locomotive are so annoying to passengers that on some of our lines a trip by rail on a hot day is something to be

dreaded, and the danger to forests and other property from fires set by these sparks is in the aggregate enormous.

To the novice the remedy for all this would seem to be to so arrange the furnace that perfect combustion would take place. This may be done on stationary or marine engines, where heating surface enough can be provided to allow of slow and perfect combustion, but in the locomotive the weight and size of boiler is limited, and artificial means must be used to provide for such rapid combustion as is required when the engine is developing its full power.

The attention of locomotive mechanics has been drawn to this question of fuel-combustion ever since the birth of the locomotive, but their efforts to make it perfect have been only partially successful, and while the heating surface of our boilers is so small in comparison with the requirements of the engines a forced draft will have to be resorted to. This fact being recognized, it necessarily follows that when the engine is developing its full power the artificial draft is so strong that small particles of coal will be lifted from the fire and drawn through the flues unconsumed and discharged out of the chimney in the form of what is called sparks. The fact that some solid matter will be drawn through the flues from the fire being established, I will now briefly consider the various mechanical contrivances that have from time to time been brought forward to arrest and dispose of these solids.

Among the earliest contrivances (when wood was the universal fuel used in this country) was a chimney shaped like a funnel placed with the broad mouth upward. This broad end was covered with a wire screen, and inside of this chimney was placed a straight pipe somewhat smaller than the smallest diameter of the chimney, its height being about two-thirds that of the chimney. Over this, and near the wire screen, was mounted a deflecting plate with edges curving downward. A spark reservoir was placed in some suitable position near the smoke-box, and pipes were made to lead from the annular space between the chimney and the inside pipe to this reservoir. The operation of this arrangement was as follows:

The unconsumed products of combustion that were drawn through the flues were driven by the exhaust steam upwards against the curved deflector at the top of the chimney, and the larger and heavier particles were forced down and into the spark reservoir. The lighter particles would pass to the atmosphere through the wire screen, but would rarely have life enough to set anything on fire. The reservoir, however, was soon abandoned, as it was found in practice that with wood for fuel the sparks were so reduced in size by friction in their passage through the flues and chimney that they could all pass through the screen to the atmosphere with little danger of setting fires.

When coal came to be used as fuel the old arrangement of chimney was found to be unsuitable, and new appliances had to be devised. A new and annoying element had to be met—that of gas and smoke, caused by imperfect combustion in the furnce. When fresh coal is added to the fire a vast quantity of gas is evolved, and unless a sufficient quantity of atmospheric air is brought into immediate contact with it it will pass off in the form of smoke.

Various plans to furnish the requisite amount of air, and at the proper time, have been tried, but the varying conditions under which the engine is working have so far made it practically a failure.

Letting air into the furnace over the fire, while it will prevent the formation of smoke if let in in sufficient quantity, will also lower the steam-producing qualities of the boiler. Air mixed with a jet of steam driven into the furnace over the fire has been tried at various times and in various ways, but it has always ended in failure. D. K. Clark, the eminent English engineer and author, in his work on the locomotive, describes a method of injecting air and steam mixed into the furnace of a locomotive boiler to promote the combustion of the gases.

Recent so-called inventions brought out in this country are almost exact duplicates of appliances described by Clark long ago.

Rotary blowers have been used to drive the products of combustion from the smoke-box back to and into the furnace to be subjected to a reburning process, but such methods never got beyond the experimental stage. Double or twin furnaces have been tried, but while producing good combustion the mechanical difficulties to be overcome have thus far interfered with their success. Mechanical devices in various forms for driving the solid, unconsumed products of combustion from the smoke-box back through suitable tubes to the furnace were several years ago quite largely used, but they have nearly all given way to more modern and better methods.

I will now proceed to discuss the most approved methods of promoting combustion, and also the mechanical means employed to prevent the escape of sparks from the chimney, drawings of which will accompany this paper.* And here let me say, curi-

ous as it may seem, the wonderful discoveries made in the last twenty years in the production of steel have a direct bearing on the question under discussion.

The substitution of steel for iron in rails and tires has made it possible to so increase the weight of the locomotive that larger boilers can be used, and therefore a very much greater heating surface in proportion to the cylinder area. This fact makes it possible to do what could not be done were soft iron rails and tires still in use.

The modern locomotive boiler has little to distinguish it from its prototype of thirty years ago. All combustion chambers, water tables, and complications of all kinds have been discarded, and we have the plain rectangular furnace, with plenty of tubes to freely carry off the products of combustion. Its leading feature is its size and large heating surface. Its enormous evaporative power will be recognized when I say that this boiler, when pushed to its full capacity, will convert three thousand gallons of water per hour into steam. To accomplish this amount of work on a grate surface of only eighteen square feet very rapid combustion must be maintained, and this can only be done by a forced draft. A forced draft means imperfect combustion, and imperfect combustion means particles of unconsumed coal drawn through the tubes. These unconsumed solids must be arrested in their course to the atmosphere and deposited in receptacles where their presence will not be harmful. This is measurably accomplished by the use of the appliances shown in the drawings.* The smoke-box is made twice the usual length; a coarse wire screen is drawn across high enough to be above all the boiler flues; the chimney is a plain, open pipe, smooth and free from obstructions; the exhaust pipes are carried up through the screen, terminating in a single nozzle. In front of the flues a deflecting plate is placed at a suitable distance from the ends of the flues, and is set at an angle of about twenty degrees. The functions of this plate are twofold—first, it equalizes the draft through the flues; and, second, it deflects the sparks downward, and instead of their being shot upward through the chimney they are banked up in the forward end of the smoke-box, there to remain until they are removed at the end of the trip. In the furnace is placed a fire-brick arch, extending entirely across the furnace and from the flue-sheet under the flues back about two-thirds of the length of the furnace. The gases, as they arise from the coal, are forced to travel back and over this arch on their passage to the flues, and by the delay thus caused, and also by their contact with the intensely hot fire-brick composing the arch, are very thoroughly consumed. The unburned solids lifted from the fire are also prevented from being drawn directly into the flues, the force of the draft caused by the exhaust steam in the chimney causing them to impinge against the hot brick, where the heat is so intense that a large percentage of them are consumed that would otherwise be drawn through the flues in a solid state. The brick arch is supported on four iron tubes, placed diagonally in the furnace, connecting the water-space under the flues with the water over the furnace crown. These tubes not only make a reliable support for the brick, but best promote the circulation of the water in the boiler.

The arrangement of smoke-arch described is not of recent design, but was patented in substantially its present form about twenty years ago by Mr. John Thompson, of East Boston, who was then connected with the Eastern railroad in the capacity of master mechanic. It was tried thoroughly by him at that time, but was abandoned, for the reason that a comparatively few miles' run would fill up the smoke-arch with sparks and so interfere with the draft that the capacity of the boiler to generate steam in sufficient quantities to supply the wants of the engine was destroyed. The small furnaces used at that time and the powerful artificial draft made necessary thereby produced this result.

As I stated in a former paragraph, the introduction of steel for rails and tires made the use of larger boilers possible, and with their introduction came the successful use of the spark-consuming and arresting devices described. The railroad with which I am connected has had these appliances in use on a limited number of engines for the past two years, and in no case has a forest or other fire been set by them, and if kept in proper order I believe they are absolutely safe.

In conclusion, I wish to say that careful and intelligent manipulation of the fire by the fireman is imperative, and will do more to prevent the formation of smoke than any mechanical contrivances.

---

*The illustrations being familiar to our readers, it is not thought necessary to reproduce them.

THE FUTURE OF THE FORESTS OF THE LOWER SOUTHERN STATES AND THEIR PROBABLE TIMBER SUPPLIES.

BY CHARLES MOHR, OF MOBILE, ALA.

It is a well-known fact that the tree-growth of a forest is, in the course of time, succeeded by another of a different kind. Such a change in the character of the forest vegetation proceeds either slowly, by the gradual encroachment of the invading species until those occupying the ground originally have disappeared or are rapidly disappearing, or by the more or less sudden destruction of the original forest-growth. From a closer study of the struggle going on amongst the trees for the possession of the soil important inferences can be drawn, first, as to the species which succeed best in adapting themselves most readily to the change of the conditions involved in the gradual or more or less sudden removal of the original growth, and, secondly, as to the resources of timber and other forest products to be expected from those by which it is succeeded.

In view of the changes which have taken place in the forests of the Northern States by the clearing away of the largest part of the original tree-covering, and which begin to affect seriously the industrial and commercial interests of large populations as well as those of agriculture, it might be well to consider the facts which in this respect present themselves in the lower Southern States, and especially in those of the eastern gulf region, with their great timber districts, the seats of important and vastly increasing industries, based upon their resources.

That the rapid depletion and final destruction of the forests of this section, by the devastation attending the existing methods of management of their resources, is inevitable, with little or no hope for their restoration, can be regarded as certain, and in contemplating this grave fact the questions in regard to the future prospects offered by the second forest-growth suggest themselves forcibly to the mind.

Considering, first, the supplies existing in one of the most extensive and important timber regions of the South, the maritime pine-belt of the Eastern Gulf States, we cannot fail to arrive at facts fraught with important results, pointing to the measures to be adopted for the maintenance of its timber resources, and well calculated to arouse the attention of the intelligent citizen who, looking beyond the narrow limits of self-interest, bestows a thought upon the present and future general welfare of his country.

This coast pine-belt, reaching from the Chattahooche river to the lowlands of the Mississippi river, covers about 38,000 square miles, inclusive of the lands covered by water, cleared or otherwise, not covered by the long-leaf pine. In its extent through Alabama and Mississippi the merchantable timber of long-leaf pine standing at the end of 1880, according to the estimates made for the tenth census, amounted in the first of these States to 16,055,000,000 feet, board measure, and in the latter to 18,200,000,000. In the light of the scanty information obtainable the annual cut during the past five years, beginning with the close of the census year, can be estimated to have averaged 140,000,000 feet, board measure, in Alabama and 102,000,000 feet in Mississippi.

This cut reduces the amount of the supplies standing in this pine-belt at the end of the present business year in the first of these States to 15,355,000,000 feet, and in the latter to 17,660,000,000 feet, board measure.

Under such present strain the timber supply of Mississippi will last a little over 170 years, a period of sufficient length to afford the time needed for the production of the same kind of timber equal in quality to that of the original growth. The long-leaf pine can be said to furnish in from 150 to 175 years timber of the size and quality required. Hence, if care were taken to restock the denuded acres by natural seeding, and to protect the new growth from the invasion of objectionable species and from the inroads of fire and cattle, the resources of the pine forests of Mississippi could be fully restored before the exhaustion of the original stock. With the stock on hand their maintenance would be a matter of comparatively small expense, if managed properly under the guidance and protection of laws enacted by the State and upheld by an intelligent and patriotic community.

Nature has wisely provided that timber will flourish on lands the soil of which is too poor to yield profitable returns under cultivation for any other crop, and lands of this class should be forever devoted to the purposes for which they are naturally best adapted and intended. To that class of lands belong by far the greater part of those covered with the long-leaf pine forests. Deprived of their timber-wealth, these lands are rendered entirely valueless. They will, however, under the system indicated soon

become valuable, and thereby the prosperity of the State and the individual, both for the present and future, would be greatly advanced.

In Alabama, where at present rates of consumption the timber supply will last, to all appearance, but little over a century—that is, about two-thirds of the time required for its restoration—no wiser policy could be adopted than to reduce the cost accordingly.

Such reduction alone, in conformity with the natural law of reproduction, would have a tendency to advance the prices of all kinds of timber and other products of the forest to a height more in accordance with their intrinsic value, based on the cost of production, if it had to be effected at the expense of time and labor of men, and, furthermore, offer a safeguard against over production leading to the ruinous depressions in the trade by glutting the markets. Any one engaged in the lumber business, timber trade, or the production of naval stores will have to admit that thousands upon thousands of acres of the best timber lands have been uselessly destroyed and their products wasted in having been disposed of at prices affording no profit whatever to any one connected with the business, not to mention the irretrievable destruction of values, which has caused the financial ruin of many.

It must not be overlooked that the drain of these forest resources will rapidly increase with the increase of population in the timberless regions and with the impending depletion of the white pine of the Northwest.

According to the above statements, the demands made during the last five years upon the timber supplies in this pine belt within the two States cited, required the depletion of over 400,000 acres, tending to a total destruction of the original timber growth of that area. The restoration of its tree covering being left here as elsewhere solely to the effort of nature, the second growth, uncared for by man, must be expected to satisfy the requirements of the future.

Beginning in the tidewater region with the examination of the resources held thus in prospect in the different districts of the Lower South, and particularly the Eastern Gulf region, it is found that in the coast plain there is no prospect for the spontaneous restoration of the long-leaf pine. The offspring of this tree, in the struggle for the possession of the soil, has to succumb to that of its allied species, the Cuban pine (*Pinus Cubensis*) and the loblolly pine (*Pinus tæda*), the first supplanting it to the largest extent in the openings made in the original forest, the latter gaining a foothold in the exhausted fields abandoned by the settler. The Cuban pine, most frequent in the flatwoods of Florida, extends along the coast westward to Eastern Louisiana; it is never found to ascend to the pine uplands or to enter the banks of the water-courses intersecting them, above the level of the tide. In the coast plain it is found in all stages of growth on the land not originally occupied by the long-leaf pine, showing a remarkable rapidity and thrift of growth. Stately groves of trees seventy to eighty feet high, and from sixteen to twenty inches and over in diameter, perfectly clear of knots for fully two-thirds of their height, furnish supplies of fuel of good quality in the surroundings of Mobile. None of these trees of second growth have been found to show over fifty rings of annual growth.

The wood of the Cuban pine is less resinous than that of the long-leaf and the loblolly pine, compact, but of a coarse grain, and the timber is inferior to that of the long-leaf pine. The specific gravity of the wood is 0.750, exceeding that of the latter species, and, according to the experiments recorded in volume IX of the Tenth Census, it is not inferior in its relative fuel value and its ultimate power of resistance under pressure; hence, entitled to more consideration than it receives at present by the trade. In view of its quick growth and the qualities of its timber the fostering of the young growth in the unpromising soil of the low pine barrens or flat woods, not improperly called in this district pine meadows, which extend over many hundreds of square miles along the eastern gulf shores, cannot be too strongly recommended.

Amongst the prominent resources of valuable timber found in the overflowed lands of the coast and in the wide alluvial river valleys with low-water level, the mighty cypress (*Taxodium distichum*) takes a conspicuous place. On account of the excellent qualities of its timber, of late years eagerly sought for, this tree is rapidly disappearing in all localities easy of access. In such the exhaustion of the supplies is a question of very short time. Those existing a few years ago in the delta of the Mobile river are almost depleted, and to meet the demand of the mills on the Tensaw river have to be brought from the distant swamp lands along the Alabama and Tombigbee rivers. The same can be said of those but a short time ago abounding in the alluvial forests of the Mississippi and Yazoo delta. It is only in the remote and at present practically inaccessible cypress-brakes in the upper parts of this alluvial region that these supplies are yet untouched. The time is, however, rapidly approaching when these will be brought into requisition, and when capital and the skill of the engineer in transporting the gigantic trunks to the streams will find proper returns for over-

coming the difficulties presented in making them available. It is almost impossible to get the data upon which an approximate estimate of the cypress timber standing in the Gulf States could be based. Certain, however, it is, that the existing supplies are rapidly brought under the control of capital. There can be no doubt that with their depletion cypress lumber will nearly disappear from the markets. Comparatively few trees below the size demanded for the manufacture of lumber are found in these alluvial forests. A young growth of this tree is found on the borders of the cypress swamps, and its seedlings spring up in the greatest abundance whenever the rays of the sun can reach the patches laid bare after a long season of drought by the receding of the water which, most of the time, covers the ground in these forests. Sound trees beyond the first stages of growth, approaching medium size, are rarely seen in the eastern gulf region. A tree felled at that stage, measuring eighty feet in height and little over thirteen inches in diameter, judging from the rings of annual growth, seemed nearly a century otd. The logs rafted to the mills average thirty-two inches in diameter and fifty feet in length, equal to 2,400 feet of lumber. Trees of dimensions to furnish logs of such size have required not less than from 200 to 250 years for their growth.

The white cedar or juniper (*Chamæcyparis sphæroidea*) is equally threatened with extinction as a source of timber. Much in demand for its light, durable wood, this timber-tree is rapidly disappearing in the Gulf States, with little prospect of its restoration. Both of the trees last mentioned are easily raised from the seed and grow without difficulty in almost any soil, in cool, damp situations, from the banks of the Ohio to the Gulf shore, their growth making considerable headway during the first twenty-five years.

Amongst the enormous quantities of hard-wood timber of inferior quality, found in the gloomy forests of the alluvial lands of the tide-water districts and commanding at present but little attention, furnished by the water oak, tupelo gum, green ash, white bay, water hickory, the water elm or wahoe is to be mentioned as one of the more valuable trees, being quite abundant and attaining here its best development, trees from two and a half to three feet in diameter, furnishing timber of excellent quality, being frequently found in these low forests.

Entering the rolling pine uplands or pine-hills, the changes caused by the removal of the primeval forest of long-leaf pine present a more striking and totally different aspect.

The seedlings of the long-leaf pine are rarely found to occupy the places of the parent tree. It is a growth of deciduous hard-wood trees which chiefly takes possession of the soil, forever excluding the offspring of the original forest tree. The blue-jack or upland willow oak (*Quercus cinerea*), Spanish oak (*Q. falcata*), black-jack (*Q. nigra*), with the mockernut hickory (*Carya tomentosa*), if undisturbed by fire, make a rapid growth, presenting on the better class of these pine lands, in the course of from forty to fifty years, copses of trees above medium size. The ridges of utmost sterility, with a soil of pure white sand, are soon covered with a dense growth of the turkey oak (*Q. catesbœi*), forming coppices, which, in the vicinity of larger towns, are every ten to twelve years cut over, furnishing fuel of good quality. The second growth of the long-leaf pine is only found in the localities accidentally protected from the invasion of the fires which scourge these woods season after season. It is found to succeed best in the broad expanse of uplands, where the porous, sandy, or gravelly soil, with but a slight admixture of clay, presents no obstacles to its deeply-penetrating taproot.

This tree shows, in the earliest stage of its development, the remarkable peculiarity that up to the fifth year of its existence it remains almost stationary in its vertical growth, until the stem has attained a certain thickness. Until the end of that period exceeding scarcely the surrounding herbage in height, and being full of resinous juices, the young trees have no chance of surviving the ever-recurring conflagrations to which they are exposed or the tramping down by the herds of cattle ranging through the woods. Protection against these destructive agencies during this stage of their growth is absolutely required for the preservation of the species. This having been afforded, the trees show a most thrifty and rapid growth up to the third and fourth decade of their life; after that period the growth proceeds slowly. Trees furnishing logs from sixteen to twenty inches in diameter seem to require not less than from 150 to 175 years to attain such dimensions. No greater benefit could be bestowed upon this section than to assist in every way the attempts of nature to renew the original tree-covering of these pine uplands, upon the existence of which depends unquestionably in such a large measure the welfare of future generations, not only through a supply of timber and other indispensable forest products, but also the preservation of conditions of climate which favor so highly the agricultural interests of these States.

In the upper division of this pine belt or region of a mixed growth, made up of various pines and hard-wood trees, the struggle for the possession of the soil among the different species is most evident. The long-leaf pine, occupying the sandy and rocky ridges, can be said to cover fully half of the area of this region. Here its progeny is brought into competition with innumerable and most aggressive foes invading its territory, to which it is sure to succumb. Of its final disappearance from these hills there can be little doubt. The most formidable and aggressive amongst them is the short-leaf pine (*Pinus mitis*). Numberless seedlings of this tree sprout up every spring; by their rapidity of growth they easily suppress the seedlings of the long-leafed species, encroaching not less upon the forests of hard woods on the more productive soil of these uplands, and taking immediate possession of any opening made in the forest and the exhausted fields thrown out of cultivation. Extensive tracts, less than half a century ago covered with magnificent forests of white, Spanish, red and black oak, brought under cultivation, and by constant cropping, for a succession of years, finally exhausted, afford in these districts good opportunities to observe the work of nature going on in the restoration of the forest. The saplings of the short-leaf pine form at first dense thickets, absolutely impenetrable. Before arriving at the tenth year the work of thinning out begins actively in this growth, by the death of the weaker saplings. Favored by the access of light and air thus gained, the surviving growth shoots rapidly upwards, the young, aspiring trees spreading out their crowns; in the meantime those lagging behind die, one after another, under the increasing shade. Having reached the age of fifty years the trees average sixty to sixty-five feet in height, from twelve to fifteen inches in diameter, standing from fifteen to twenty feet apart, with no undergrowth whatever between them. Before arriving at the age of one hundred years the trees are found to be eighty feet and over in height, with a diameter of twenty to twenty-two inches and more, the trunks clear for about one-third of their height, furnishing timber of fine quality, particularly esteemed by the house-carpenter and fully as durable as that of the long-leaf pine. Spreading with surprising rapidity over every clearing made in these uplands, from the upper part of the pine belt, through Central and North Alabama, over the rolling, loamy uplands of the northern half of Mississippi, throughout the whole of Northern Louisiana and Northeastern Texas, this pine can be emphatically called the timber tree of the future in the States of the Lower South.

It is only the loblolly pine that can be said to compete successfully with this tree in the contest for the possession of the soil, and only on the lands greatly impoverished by cultivation and in localities with moisture and a more sterile soil. One of these loblollies growing with the short-leaf pine on the highlands of North Alabama, measured, when felled, one hundred and twelve feet in height, and twenty-one inches in diameter, showing ninety-two rings of annual growth.

The loblolly pine in the lower division of the pine belt takes possession, almost exclusively, of the worn-out and abandoned lands. If less esteemed on account of the inferior quality of its timber, which quickly decays when exposed to the weather, it gains in importance if it is considered that this tree, in the near future, is to be depended upon as the earliest available resource of crude turpentine from the second growth of this section.

On the rocky summits of the mountains and on the arid ridges in North Alabama, as is also the case in the Southern Atlantic States, the worthless scrub pine or Jersey pine (*Pinus inops*) replaces the hard-wood growth. In the limestone hills and the valleys and ridges of Central and South Alabama, with a rocky calcareous soil, the young growth of the red cedar (*Juniperus Virginiana*) suppresses almost completely that of any other tree wherever the upland oaks, hickories, chestnuts, &c., have been cut down. The most advanced of this second growth furnishes an ample supply of small timber, on account of its durability suitable for posts, poles, and other inferior purposes, but unfit for the higher uses for which that of the first growth is so much esteemed.

The cedar brakes in Alabama and Western Florida are rapidly disappearing.

The clearings made in the more or less extensive patches of hard-wood in the dry, sandy lands throughout Western Florida are taken possession of by the sand pine or hammock pine (*Pinus clausa*), a tree of no value—the Southern spruce pine (*P. glabra*) occupying the ground in the same section of country in the richer low hammock lands.

Less striking are the alterations in the character of the woods which take place in the forests of deciduous leaved trees in the bottom lands, fertile plains, and the uplands, with the most fertile soil. The hard-wood forests in the central and upper parts of the Eastern Gulf States, harboring yet large supplies of valuable timber of white oak, sweet gum, yellow poplar, hickory, white ash, and some black walnut, will surely

melt away with a rapidity that can scarcely be realized now, under the heavy demands of the near future created by the needs of this whole country. With the steady increase of population, the fertile lands bearing these resources, wherever they can be brought under the plow, are certain to be devoted before long, to the raising of the staple crops of this section in the same way as has happened with the rich forest lands throughout the North, where their timber supplies of a little more than a generation past had been deemed almost inexhaustible. The second growth of the rich alluvial woods, as observed in the upper part of the Mississippi and Yazoo delta, has been found to consist principally of sweet gum, red elm, water elm, honey-locust, box elder, and hackberry. Young black walnuts are frequently found springing up in all the openings in the river bottoms. None of the valuable white oaks have been seen amongst the second growth.

It would exceed the limits of this paper to dwell any further upon the details of these alterations in the character of the forests of the lower Southern States. One fact observed in this section, as elsewhere in this country, important in its practical bearings, stands forth prominently—that is, that the kinds of greatest economic value are giving way before those inferior in quality, demonstrating that the resources of our most valuable kinds of timber can only be restored by the establishment of forest plantations.

That such plantations of our most valuable timber trees, found originally only on the richest lands, can successfully be established on poorer lands of comparatively but little value is evident from the thrifty growth such trees as the black walnut, the yellow poplar, the live oak, the cow or basket oak (*Q. Michauxii*), the white ash, and others are found to make under the influences of the climate of the lower South.

Whatever is effected by the spontaneous efforts of nature in the way of the restoration of the forests, the aid of man is required to secure that which is of most value to him.

RECLAMATION OF WASTE LANDS.

BY B. G. NORTHROP, L.L. D.

There are four kinds of waste lands in the Atlantic States, including ten Southern States—

1. Swamps and marshes.
2. Sand barrens.
3. Exhausted lands, once arable and fertile.
4. Rough hill-sides, formerly good grazing ground, now overrun with worthless weeds and brush.

The reclamation of marshes by drainage, both surface and subsoil, has been carried on so long, extensively and successfully as to need no detailed discussion here. England, Ireland, and Holland contain millions of acres of such reclaimed land. Lakes, from ten to fifteen miles in length, have been thoroughly drained, and such bottoms are usually very fertile. The drainage of the Lake of Haarlem, in Holland, was completed more than thirty years ago. The lands thus reclaimed have since been sold for nearly three and a half million dollars. The success of this grand experiment has prompted many others, like the draining of the Zuid Plas, a lake covering over 11,000 acres; an arm of the Sheld, covering 35,000 acres; the enlarging and deepening the tunnel, originally cut by the Emperor Claudius, 1800 years ago, to drain Lake Celano in Italy, a work costing the Italian government over $6,000,000 and recovering 42,000 acres. Though this work of Claudius, the wonder of that age, employing 30,000 men for eleven years, was successful during his reign, it afterwards fell into disrepair, and was neglected for centuries. It is one of the many proofs of the revived enterprise of the present government, rivalling their historic ancestors, that they have restored and surpassed this old Roman work. While in our country, with vast areas of virgin soil, *such* expenditures would be unwise, there are large tracts of marshes that may be easily and economically drained. Much has already been done in this direction on the New Jersey seacoast, along the shores of Lake Michigan, on the Massachusetts seacoast, as at Marshfield, and still more in California, where over 200,000 acres have been improved by protection from overflow. The improvement of low lands by layers of sand is too familiar to need description.

But, will it pay to plant trees on a barren, sandy plain, is the practical question. Here experience is our best guide. Over 10,000 acres on Cape Cod, which thirty years ago were barren sandy plains, are now covered with thriving *planted* forests. I have visited the Cape in order to inspect these forests and observe this great transformation,

and have asked many farmers the question, Does it pay? and always received an affirmative answer. The seeds were sometimes sown broadcast, but usually dropped in furrows. The following statement of one farmer will illustrate the replies of many others. "When I came to this spot, twenty-five years ago, not a tree could be seen from my house-lot, and the land could be bought for twenty-five or fifty cents an acre. Now, covered with trees, it is worth twenty dollars an acre. Besides, it has paid me over and over in the enjoyment of the improved looks of my place."

An interesting, and so far successful, experiment in reclaiming barrens by tree-planting was begun eight years ago by Mr. H. G. Russell, at East Greenwich, R. I., on an arm of Narragansett Bay. I have recently visited this forest plantation to learn Mr. Russell's methods and their results. His previous attempts to cultivate this land were failures. "For every dollar expended in trying to fertilize for crops I could not get a return of ten cents," said Mr. Russell. Here are now over three hundred acres of planted trees. More than 500,000 trees have been "set out," and many bushels of acorns, chestnuts, and other nuts or tree-seeds have been planted in the fields where they are to grow. Sixty acres of this land were a worthless and unsightly "sand blow" drifting before the winds which sweep over these barren reaches. At first these waving sands could be held in place only by brush or other rubbish till the thickly planted trees fastened them with their intertwining, rootlets or dropping and decaying foliage. While Mr. Russell's primary motive was not pecuniary profit, but to transform those unsightly barrens into an attractive forest and form extensive wind-breaks to shelter his estate of nearly seven hundred acres, he is greatly gratified by the success of his experiment, and confident that all his expenditures in tree-planting will prove a remunerative investment. At a fair valuation, present and prospective, of his plantation, the accurate account kept from the beginning of all outgoes for trees, nuts, seeds, and labor gives a balance on the right side of the ledger. This plantation is a sort of Forest School, or rather an object-lesson for New England. Already his young forest has proved a source of great and constantly growing enjoyment, and taught him that there is a peculiar pleasure in the parentage of trees—a pleasure that never cloys, but grows with their growth.

The question has often come to me, "What kinds of forest trees will thrive best on sandy plains or hills?" The answer must vary with the climatic conditions of each State or country. Experience is here our best guide. For the reclamation of the sand barrens of Plymouth and Barnstable counties, Massachusetts, referred to above, the common pitch pine was at first generally used. Recently the Scotch pine and European larch have been widely planted. Said one of the Cape Cod farmers, who has planted over a hundred acres, "My plan, carried on for some forty years, has proved a successful and profitable experiment. Fresh pitch pine seeds, carefully gathered and worth two dollars a pound, are as sure to vegetate as corn. I have planted seeds both with a "planter" and by hand. On our light sands a man and a boy will plant three acres in a day. It will take about half a pound of seed to the acre." Another farmer said that he found the total expense of planting the pine seed to be two dollars and twenty-five cents per acre. The cost of *setting out young trees*, twelve to eighteen inches high, is about eight dollars per acre.

Douglas & Sons, of Waukegan, Illinois, six years ago began the work of reclaiming barren sand-ridges near the shore of Lake Michigan, trying pitch pine, white pine, Austrian pine, and Scotch pine. Here, as on Cape Cod, the Scotch pine proved the best for reclaiming sandy barrens.

Another very successful experiment has been tried by J. S. Fay, near Wood's Holl, in Falmouth, Mass. Mr. Fay says: "Thirty years ago this was a barren waste—the soil dry and worn out. When I bought my place, I was told that trees could not be made to grow there, and hardly any tree could be seen from my house. The Scotch pine from the seed did the best. The European larch did not start well from the seed, but from the nursery it has grown remarkably." Mr. Fay imported 35,000 plants, of which the larch has proved the most rapid grower and is the most valuable tree. He has now a fine forest of two hundred acres, which the members of the American Congress of Forestry were invited to inspect the day after its late meeting in Boston. It was regarded by all as a demonstration of the practicability of reclaiming barrens by tree-planting. In the language of the official report—

"On as bare and wind-swept piece of ground, perhaps, as can be found on our coast, and on poor soil, Mr. Fay began to plant tree-seeds thirty years ago, and here to-day is a dense body of wood, in places almost impenetrable. Many of the trees are fifty or more feet in height, The members of the Congress were delighted to see this proof that forest trees can be so easily raised from seed under such unfavorable circumstances. It was a confirmation of what they had believed and taught, and nothing more convincing or encouraging could be asked for. Said Mr. Fay, "Farming would not pay in such a situation, but raising of forests would."

There is no longer any need of importing larch, or any economic trees. Douglas & Sons, above named, furnish the two-year-old plants for four or five dollars per thousand. G. H. Wright, a nurseryman of Sioux City, Iowa, who sold over ten millions of trees last spring, offers the seedlings or yearlings of white ash, soft maple, or box elder at one dollar and a half per thousand; white or red elm at two dollars per thousand; catalpa speciosa at six dollars, provided that not less than 10,000 are in one order, the purchaser to have the right to select such varieties of trees from his full list as he may desire to make up the 10,000.

An extensive experiment for the reclamation of beach sand lands was tried most successfully nearly a hundred years ago, along the coast of the Bay of Biscay, where the sand-hills, or dunes, as they are called, stretch over a hundred miles. These dunes, ranging from 180 to 320 feet above the level of the sea, are composed of white, silicious sand, rounded and reduced to minute grains by trituration. These grains are still too heavy to be borne aloft by the winds and scattered afar like the ashes of volcanoes. On the Atlantic shore of France the prevailing winds are from the west and southwest. Hence, at low tide, the sands, dried by the sun and the wind, are driven as along an inclined plane, up the slopes which descend seaward, and thus form these growing dunes, which, moving inland, have created great desolation.

The practicability and even the possibility of reclaiming such sand barrens is so generally doubted, that it is needful to show what has been done in this direction under conditions the most unfavorable and where it was confidently predicted nothing could be made to grow. The feasibility of reclaiming our barren wastes is proved by many facts abroad and at home. Our Atlantic sand-planes were once covered with forests. The now bare, white sand-hills of Provincetown were described by the Pilgrims on their landing there as well wooded. The sand-hills on the coast of Prussia were formerly wooded down to the water's edge, and "it was only in the last century" (says Geo. P. Marsh) "that, in consequence of the destruction of their forests, they became moving sands." The history of the dunes of Michigan is the same. Fifty years ago, when that region was scarcely inhabited, they were generally covered with a thick growth of trees, and there was little appearance of undermining and washing on the land side or of shifting of the sands, except where the trees had been cut or turned up by the roots. The sand dunes of Denmark cover over 160,000 acres; those of Prussia, 110,000; those of the single province of Gascony, in France, over 200,000, and in all Europe the drifting sands, according to Pannewitz, cover 7,000,000 acres. Says Marsh, "There is no question that most of this waste is capable of reclamation by simple tree-planting, and no mode of physical improvement is better worth the attention of civilized governments than this. There are often serious objections to extensive forest-planting on soils capable of being otherwise made productive, but they do not apply to *sand wastes*, which, until they are covered by woods, are not only a useless incumbrance, but a source of serious danger to all human improvements in their neighborhood."

This is a subject of practical interest to us, because we have along our coast, as in Massachusetts, in Connecticut, in New Jersey, in Delaware, in Maryland, and other Atlantic States, on the gulf coast, on the eastern shore of Lake Michigan and elsewhere, long tracts of drifting sands that have done serious local damage. To stop their extension considerable expenditures have already been made in several States to cover their surface with a vegetable growth. But this reclamation of barrens and sand dunes has been carried on most extensively and successfully in Europe. Nearly a century ago Bremontier published a memoir on the reclamation of sand dunes. Under the patronage of the French government, he successfully introduced the planting of the maritime pine along the Atlantic coast of Gascony. These plantations have been perseveringly continued from that time to the present, and now cover over 100,000 acres in the single district between the rivers Adour and Gironde. Not only has this wide area been reclaimed and made productive soil, but a still greater extent of fertile land has been rescued from the destruction threatened by the advancing sand-hills. In speaking of the monument erected to Bremontier, in this now stately forest, Marsh says: "He deserves to be reckoned among the greatest benefactors of the race."

In planting the dunes, a barrier along the shore was found necessary at first to protect the young trees from the rolling sands, which otherwise would bury them. A double line of paling was erected parallel to the shore and a hundred meters from high-water mark, the second line being a hundred meters further inland. This paling is made of planks sharpened at the lower end and driven into the sand. Spaces of an inch between the planks, allow sand enough to pass through to bank up equally on both sides and relieve somewhat the force of the wind by allowing it to pass through these openings. As the paling is covered by the sands, the planks are raised, one at a time. A movable frame, with a long lever and mounted on runners, so that it can be slid along the top of the fence, and having pinchers and a chain, is easily carried and

operated by one man. France now draws an annual revenue of 130,000 francs from the resinous products of these forests. But in this case, the greater profit comes from the consequent protection of the adjoining country from the encroaching sands, which had formerly sterilized fertile regions and buried thriving villages. M. Samanos says that "in all France nearly one million acres (400,000 hectares) of desolate land, supposed to be doomed to everlasting sterility, have been reclaimed, and these savage deserts are now stocked with maritime pines, which will become for the country a fruitful source of wealth and supply some day the wants of the whole of France."

I will name a few illustrations of the extent of this work. Hummel attributes the devastation of the Karst, the high plateau lying north of Trieste—until recently one of the most parched and barren wastes in Europe—to the felling of its woods, centuries ago, to build the navies of Venice. The Austrian government is now making energetic, and thus far successful, efforts for the reclamation of this desolate waste, having planted over half a million of young trees and sown great quantities of seed. In the vicinity of Antwerp, less than fifty years ago, was a vast desolate plain. Looking to-day in the same direction, from the spire of the cathedral, one can see nothing but a forest whose limits seem lost in the horizon. Forest plantations have transformed these barren lands into fertile fields. On the Adriatic, Baltic, Mediterranean, as well as the Biscayan coasts, the disastrous encroachments of the sea have been checked by forest plantations. Extensive plains, once barren sands, south of Berlin, about Odessa, and north of the Black Sea, and vast steppes in Russia are now well wooded.

All sand wastes are by no means alike. Trees which will grow luxuriantly on one will pine away and die on another. The climate, too, varies as well as the soil. The soil of Cape Cod and Nantucket is well fitted for the maritime pine, where it has been amply tried. It grows well for a season or two, but is sure to winter-kill in a few years. It suffers from the severity of the winter in Holland and Germany. Sea-spray and saline constituents in the soil or air are fatal to some trees and favorable to others. A knowledge of the natural growths of each vicinity will favor adaptation to local conditions.

Though dry at the top, sand dunes and most sand plains and hillocks are *moist* a little below the surface, by reason of evaporization from the lower strata, retention of rain-water, and capillary attraction. The latter cause depends upon the size of the grains of sand. The finer the grains the greater is the capacity for receiving moisture and the longer is the moisture retained.

The benefits that may accrue to our country from the discussion of tree-planting, were strikingly exhibited 220 years ago, when Sir John Evelyn published his celebrated work, entitled "Sylva; or, A Discourse on Forest Trees and the Propagation of Timber." It was at once received with great popular favor and honored with royal commendation. He had remarkable success in awakening general interest in sylviculture. It was written while he was employed in an entirely different branch of public service, but, as he says, "from an earnest desire to support the credit of the Royal Society, and to convince the world that philosophy was not barely an amusement, fit only to employ the time of melancholy and speculative people, but a high and useful science, worthy the attention of men of the greatest parts and capable of contributing in a supreme degree to the welfare of the nation." He was one of the founders of the Royal Society, and wrote this book at its special request, and that society has originated few books in the last 200 years more useful than this one, which still survives, in its grand results, although his other works on painting, sculpture, architecture, and medals have long since been forgotten. In many ways England has recognized her great obligations to the man who worked so lovingly and so effectively for the good of his countrymen. Disraeli, in his "Curiosities of Literature," fittingly says: "Had Evelyn only composed the great work of his Sylva, his name would have excited the gratitude of posterity. The voice of the patriot exults in the dedication to Charles II, prefixed to one of the later editions, in which he says: 'I need not acquaint your majesty how many millions of trees have been planted throughout your vast dominions at the instigation of this work, because your majesty has been pleased to own it publicly for my encouragement.' Surely, while Britain retains her position among the nations of Europe the Sylva of Evelyn will endure among her triumphant oaks. It was a retired philosopher who aroused the genius of the nation, and who, casting a prophetic eye towards the age in which we live, contributed to secure our sovereignty of the seas, for the navy of Great Britain was constructed with the oaks which the genius of John Evelyn planted."

These successful experiments, tried in so many European countries, on so broad a scale and for so long a period, and even on the most unpromising beach-sands, show the practicability of reclaiming our barrens, not necessarily by planting the same trees, or by the same methods, but by those plans which the study of local conditions may

suggest. Aside from direct profit, what can add so much to the attractions and, therefore, the worth of the farmer's home, as that recuperation of any surrounding barrens which shall literally make the desert "bud and blossom as the rose?"

If one is to be commended who makes two blades of grass grow where but one grew before, how much more the farmer who makes forests thrive, where nothing now grows?

SEA-COAST PLANTING: ITS IMPORTANCE, PRACTICABILITY, AND METHODS.

BY WM. C. STRONG, NEWTON HIGHLANDS, MASS.

Our visitors from the fertile regions of the West undoubtedly receive the impression that the soil of New England is thin and poor—that the hills are barren and the growth of wood is meager and stunted. They notice intervals and selected spots which are highly cultivated and enriched. But the prevailing aspect, it must be confessed, is that of an impoverished soil.

Very different was the impression produced upon the early voyagers to these shores. Though accustomed to the luxuriant growth and the stately forests of Old England, yet they uniformly report in glowing terms of this goodly land.

Gosnold, who is believed to have been the first Englishman who set foot on the soil of Massachusetts, describes the island which he named Martha's Vineyard as "full of most pleasant wood, vines, gooseberry bushes, hurt-berries, raspberries, eglantine," &c. Of one of the Elizabeth Islands he speaks as "overgrown with wood, viz., oaks, ash, beech, walnut," &c.

In 1603 Captain Martin Pring writes of the "goodly groves and wood" along the coast at what is now Saco, Kennebunk, and York, in Maine. Twenty years later the Pilgrim settlers confirmed the fact that the land was well wooded and the few open open spaces were rich and productive.

Emerson is warranted in saying that "a few generations ago an almost unbroken forest covered the continent." (This is true at least of New England.) "The smoke of the Indian's wigwam rose only at distant intervals, and to one looking from Wachuset or Mt. Washington the small patches laid open for the cultivation of maize intercepted not perceptibly the dark green of the woods."

And this growth of trees was extended even down to the sea.

The company sent out from the Mayflower, when at anchor in the roadstead of what is now Provincetown, reported of Cape Cod that it was "well wooded and the appearance of the soil was promising." In Mourt's Relation, printed two years later, this same Cape is described as "wooded to the brink of the sea," "compassed about to the very sea with oaks, pines, junipers, sassafras, and other sweet-wood;" and again, "all wooded with oaks, pines, sassafras, juniper, birch, holly, vines, some ash, walnut—the wood for the most part open and without underwood, fit either to goe or ride in;" and of Clark's Island and Plymouth harbor, "fine islands, wherein are nothing but wood—oaks, pine, walnut, beech," &c. Of Nantasket (now Middleboro) he says "there is much good timber, both oaks, walnut, fir, beech, and exceeding great chestnut trees; and although the country be wild and overgrown with woods, yet the trees stand not thicke, but a man may well ride a horse amongst them." The Pilgrims report Plymouth harbor as "compassed with a goodly land and the country was well wooded." Eleven years later Wm. Wood describes Boston as "being a neck which hath very good land, affording rich corn-fields and fruitful gardens, but as being bare of wood. Their greatest wants be wood and meadow ground, which never were in that place, being constrained to fetch their building timber and fire wood from the islands in boats." To relieve the good people of Boston an order was passed in 1632 allowing them to take wood from Dorchester (now South Boston) for twenty years. The same author describes the islands near Boston as follows: "In any of these harbours, the seamen having spent their old store of wood and water, may have fresh supplies from the adjacent islands, with good timber to repair their weather-beaten ships. Here, likewise, may be had masts or yards, being store of such trees as are useful for the same purpose." "And whereas it is generally conceived that the wood grow so thick that there is no more cleared ground than is hewed out by labour of man, it is nothing so; in many places divers acres being clear, so that one may ride a hunting in most places of the land, if he will venture himself for being lost. There is no underwood saving in swamps and low grounds that are wet."

The early records of Charlestown speak of it as "an uncouth wilderness full of timber." Of the shores of Cape Ann, in 1630, Winthrop says "we might see the trees in all places very plainly."

Morton's New English Canaan mentions "abundance of ash, elm, beech, walnut, chestnut, pine, cedar, cypress, spruce," &c. Josselyn's Rarities, in 1672, states that "the country is extremely overgrown with wood."

Thus we see there are abundant authorities confirming the current traditions that not only the inland, but also the islands and the shores were heavily wooded to the very brink of the sea.

It is foreign from my purpose to consider the climatic changes which have resulted from the destruction of these forests. Neither can we stop to consider the waste to the soil by reason of the exposure of wide stretches of country to the sun, the winds, and the rain, with no fresh deposits of vegetable matter to counterbalance the loss. It is enough for our present purpose that we recognize a vast change in the productiveness, especially on the islands and headlands of our seacoast. So poor is the soil and so bleak are the positions, that the impression prevails that it would be useless to attempt to replant and restore these shores to their former verdure. But the efforts of nature to cover every naked spot with vegetation are so universal and so persistent that we may well believe she would herself, if left undisturbed, in process of time, supplant the lower forms of vegetable growth until she could restore the stately monarchs of the wood. And we cannot doubt that by a judicious observance of the laws of nature, and by a persistent and systematic protection, forest belts may be successfully restored, even upon the bleakest shores, in a comparatively short time. Upon this point we are not left to conjecture. There are abundant experiments which prove the practicability of reforesting these shores.

Referring to the utterly barren sands of Cape Cod and Nantucket, Emerson cites the examples on the west coast of the continent of Europe, particularly in Holland and in Gascony, in France, where are "similar and more extensive wastes of drifting sands, called dunes or downs, which from time immemorial had been barren. These were tossed about by the winds like the waves of the sea, the whole aspect of the desert being sometimes changed by storm—valleys taking the place of hills, and hills of valleys." Quoting from Decandolle, he says (Physiologie Végétale, p. 1236, vol. 3): "The Dutch had for a long time been in the habit of sowing these downs with beech-grass, that its long matted roots might fix the sand. But if this takes from the sand its power of injuring, it leaves it wholly useless. I was struck with this defect and pointed out the advantage of planting trees there. I was not then aware that the engineer, Bremontier, had, as early as 1789, made trials of this very expedient on the downs of Gascony. Its success has since been made public, and I had the pleasure of witnessing it with unaffected admiration. The process of Bremontier is remarkable for its simplicity. He sows in the loosest and dryest sand the seeds of broom (*Genista scoparia*) with those of the maritime pine, and covers the surface sown with branches taken from the nearest pine forest. The object of the branches is to arrest the sand for a time and keep it from blowing away. The plants of the broom spring up first and by their rapid growth serve to retain the sand in its place and to shelter the young pines. These continue to grow for seven or eight years under the shelter of the broom, the leaves of which annually mingle with the soil and fertilize it. After this the pines overtop the broom and often kill it by their shade. At the age of ten or twelve years they begin to thin the forest to make tar and to get branches for continuing the process of sowing. In about twenty years they begin to cut down the trees to extract the resin. These forests, situated on the downs along the sea, protect from the continual action of the west wind the whole space situated behind them, and thus at the same time that they themselves furnish an important product they secure those of the rest of the country."

I have quoted this extract at length because it covers the question so fully, and shows conclusively that the bleakest and poorest shores may be reclaimed. Other instances of success might be cited, and it is proposed that you should personally inspect the extensive and successful plantation of one of our enterprising citizens in this direction. Of course it is evident that our islands and shores are not to be reclaimed by the ordinary methods of tree-planting. They are too poor in soil and too much exposed to the fierce ocean winds to warrant the promiscuous planting of trees of any size. But we may with all confidence follow the example of Bremontier. It is safe to say that we have no more discouraging spots on our entire coast than he found on the shores of Gascony. In most cases we might advance from seeds to seedlings of two or three years' growth as the commencement of the shelter. And we have a native growth in the common pitch-pine (*pinus rigida*), a tree equally as hardy, as valuable, and quite as well adapted for this purpose as the maritime pine. It will not only endure the bleakest ocean exposure, but also the dashing of spray and the temporary saturation of the soil with salt water. It may, therefore, safely be considered the advance guard for all other trees along our northern coast, and it will thrive in the poorest soils, where scarcely anything else will grow.

The average growth of pitch-pine on sandy plains, too poor for cultivation, is from twelve to eighteen inches per annum, and it is found that such soils, in a period of about fifty years, may be covered with pines a foot in diameter and forty or fifty feet high. It cannot be doubted that beginning with seedling pines two or three years old, together with sweet fern (*comptonia*) and our native white birch, a narrow belt might be established along the coast which would soon afford protection for other hardy trees of more rapid growth. The late Frederick Tudor erected a high lattice-work on the bleak promontory of Nahant, behind which, sifting as it were the ocean blasts, he was able to raise all our fruits with eminent success. The Scotch, Austrian, and white pines would require but slight shelter to join the ranks and speedily cover our sandy coasts. For the stronger soils the oaks, the white spruce, and numerous other varieties would speedily follow. Thus, by a wise, patient, and persistent method, from small beginnings, we may with certainty and in a moderate number of years convert the bare and desolate islands and headlands of our harbors and the sandy barrens along the coast into groves of luxuriant verdure. What a protection such a belt would be to the inland country! What a protection to such a harbor as Boston! And especially what a transforming effect in the beauty of scenery! The general impression of the islands in our harbor is that of barrenness and desolation, with here and there a small group of trees as a slight relief. But how exceedingly beautiful might these numerous islands and inlets and vistas be made, if relieved by a healthy growth of pines and oaks and arching elms. It is no wonder that the early voyagers to these shores were enthusiastic in their description of the abundant woods of this goodly land. Even to the brink of the sea they suffered not in comparison with the stately forests of old England.

It is not to be doubted that the extent of forest had not only an effect upon the distribution of rain, upon the humidity of the atmosphere and of the soil, and upon the currents of wind, but that also the soil was annually enriched by fresh deposits of vegetable matter, which was protected by the shade, and not allowed to dry and blow or wash away. The process of deterioration has been going on for more than two centuries and it is true that we now have to start as at the beginning. Yet in manifold ways the end is so desirable that it is worthy of all effort to attain it. It is a slow process to restore the soil to its pristine fertility. But it is by no means such a task to clothe our coasts with the verdure of forest-growth. In a single generation the whole aspect may be changed. And if this were the sole object to be gained, the beautifying of the harbor and the coast, it would yet be worthy of all effort to attain it. The yearly-increasing taste for sea-side residences, the popularity of steamboat excursions and public resorts, the vast amount of coast and ocean travel, is making it correspondingly important that our shores should be made attractive. When such marked improvement might be obtained at slight cost of money, time, and co-operation—when manifold other advantages are also apparent—does it not seem to be wise to secure combined enterprise, and possibly *State* encouragement, to the end that our shores may again wave with verdure?

TRANSPLANTING EVERGREEN TREES.

BY WM. C. STRONG, NEWTON HIGHLANDS, MASS.

In the northern belt of the United States the time for the successful transplanting of trees is so limited that the work is necessarily hurried. In this respect the western shores of Europe, which are affected by the warm breath of the Gulf Stream, present a great contrast. In England, for example, the work of transplanting proceeds in every month from October until May.

We, on the contrary, have a brief limit of about a month in the fall, and but little more time in the spring. For evergreens, the month of May has generally been considered the only suitable time. It is agreed by all that they should not be moved late in the fall, nor even in early spring. As their name implies, evergreens are always in foliage, and consequently are at all seasons demanding a supply of sap from the soil. If a spruce tree, for example, is planted in March or April, when the ground is wet and cold, the roots will remain inactive, while the dry winds are searching through the branches, and in order to supply the evaporation the leaves are making a severe and oftentimes fatal draft upon the sap of the tree. The case is still worse when a tree is transplanted late in the fall, for the roots cannot take hold until the ground becomes warm in the spring, and yet the leaves are in action to some extent, even in winter. It would therefore seem essential to plant at a time when the roots can speedily move and obtain a supply for the demand from above. In May the ground is becoming warm—the dormant life of the tree is aroused—the roots are coming into action and

form rapidly. It is therefore a good month for planting. But the young growth in June is soft, the days are hot, evaporation is excessive, and as a consequence transplanting is often a severe check. It is well known that most kinds of evergreens make little growth for the first season after planting.

Are we, then, limited mainly to the month of May for doing this work? I am sure that both theory and results will answer No. A consideration of the nature and habits of evergreens will indicate that in some respects even more favorable conditions may be obtained in August and early September than in May. The roots of most evergreens continue to grow throughout the summer. If they are summer pruned with a spade new roots are freely thrown out. On the contrary the growth of branches of most kinds is in June and early July. After this the only process is the maturing and hardening of the growth. Now it would seem, upon this statement, that all the conditions for removal are obtained in August. The wood is now fairly hardened and evaporation is much less than in June. There is to be no immediate tax for new growth. At this season the earth is thoroughly heated, and when well pulverized gives a gentle moisture and warmth, which greatly encourages the formation of new roots. Moreover, the nights are cooler and dewy, so that the tree has, as it were, a gentle bottom heat, with coolness and moisture at the top. These are the precise conditions for the propagation of evergreens from cuttings. It is well known that cuttings taken in August will root more speedily than at any other season. And a young tree being only an advanced cutting, it stands to reason that it will as readily form new roots in August and become established in its new quarters.

But may we expect that it will get such hold in the soil as to be able to endure the winter drain? This is a question to be settled only by experiments. In the year 1870 I made a trial so extensive and so severe that I have since considered the question as fully answered. I will state the facts. Having a tract of land which I decided to convert into a pond for the purpose of cutting ice, it became necessary to transplant about 40,000 spruce, hemlock, arbor vitæ, and other evergreens in the month of August. These trees were of the usual nursery size, from two to five or six feet in height. The field to which they were removed was about half a mile distant, rather exposed, and on the north side of a hill. It had been previously well ploughed, with furrows opened as for potatoes. But August proved to be an exceedingly hot, dry, and cloudless month, the sun glaring like a ball of fire day after day and week after week. Yet the work must proceed in spite of the opinion of an eminent planter that every tree would die. At the commencement each tree received the third of a pailful of water after planting; but this process was laborious and was not continued for the bulk of the trees. The work proceeded for weeks in the broiling heat, without a drop of rain, until it was finished about September 15th. I had occasion well to remember the remarkable fall drouth which followed—the projected ice-pond receiving no water until late in November. Yet the result was a complete success, with scarcely the loss of a tree. It was a pleasure to take up samples in November and see the mass of young roots which had formed in the soft, virgin soil. The fact that they had received no rain was more favorable to the formation of roots than cold and excessive autumn rains would have been. And I felt sure that, though the trees had been taken from a sheltered valley and placed on a cold north exposure, yet they had such new root-vigor that they could well endure the drafts of winter. This proved to be so—scarcely a tree being injured in the following winter, and the growth during the next summer was as vigorous as though the trees had not been removed. This trial was so extensive and under such severe tests, resulting in such complete success, that I have since regarded the month from August 15th to September 15th as eminently suited for transplanting evergreens. Of course the usual conditions to protect the roots from sun and air are to be carefully observed, and also a word of caution may be added: that if forwarded in boxes for any considerable distance when the weather is hot, some precaution should be taken to prevent heating.

CULTURE OF THE BLACK WALNUT IN NORTHERN LATITUDES.

BY HON. H. G. JOLY, OF QUEBEC.

I have been asked more than once what induced me to choose, of all trees, the black walnut, which does not grow spontaneously here, being only found as a native tree further South, and why I should risk the expense and trouble of making large plantations of it.

I chose it on account of its great commercial value, so much above that of all our native trees, either oak, pine, or spruce, and I do not regret my choice, as the black

walnut grows more rapidly than any of those trees, and is as easy to cultivate from seed, easier in fact, than the pine.

But will it stand our winters? On that point my experience may be of some use, and I hope it will encourage the culture of such a valuable tree as the black walnut in such high latitude as ours, forty-six degrees forty minutes north, near Quebec.

Until this last summer, 1885, the result of the last twelve years appeared to justify the conclusion that the black walnut can stand even our Quebec winters, with impunity. The effect of last winter's exceptional severity compels me to speak with more reserve, as it killed about three hundred of my young black walnuts which had safely stood the ordeal of several winters. However, I do not regret the loss, as it has shown me how to prevent its recurrence and provide against more serious loss in the future.

When the spring opened, those young trees showed no signs of distress. Their buds began to swell, like the buds of other trees; a few even opened. It took some time to realize that vegetation was at a standstill with them. The stem and branches looked healthy, the bark fresh, the under bark green. A few bore marks of sunburn, but the same marks were found on some of the growing trees. I was quite puzzled, as long as I looked *above ground.*

And here I must express my sense of the great benefits rendered by the Horticultural Associations, whose members generously place at the disposal of the public, in their printed reports, the results of their labors. I found in the Report of the Transactions of the Mississippi Valley Horticultural Society for the year 1884 the explanation, which I had long sought in vain, in the remarks of Mr. Peffer, of Wisconsin, as reported on page 187 of said Transactions. He says: "I could not see how my trees were damaged until I looked below the surface of the ground."

Up to that moment I had hesitated to dig up my trees, hoping that they might still escape. But I followed Mr. Peffer's lead—dug up some of the trees, and found out what was the matter with them. They were completely gone. The bark of the roots was all mildewed, burst, and completely separated from the wood for a depth of from twelve to fourteen inches from the surface; below that it was quite sound, adhering closely to the roots. It was evidently the result of the frost acting on the water contained in the soil and in the roots.

But why, out of several thousand black walnut trees growing on the same soil, and with the same conditions of moisture, did I lose such a small proportion as only three hundred? The answer was easily found. All the trees killed by the frost were standing in parts of the plantation where the first snow had not rested, as there happened to be there no obstruction to prevent its being swept away by the wind, and where the unusually heavy rains of last December left a coating of ice round the foot of the tree.

The trees growing where fences and hedges arrested the snow and caused it to remain on the ground, escaped, without one single exception, though many were just as much exposed to the force of the wind as those that were killed, as they stood *on the same side* of the hedge, but where the ground was covered with snow. That made all the difference. The snow had protected the roots from the frost and prevented the formation of ice round the foot of the trees. Three different plantations, widely apart from one another and on different soils, gave exactly the same results.

It is easy enough to cause the snow to remain where it is wanted, especially by means of hedges. A willow hedge costs next to nothing—just the trouble of sticking the cuttings into the ground at the proper season, when they will never fail. Those hedges are as useful in summer for the young trees as they are in winter. A knowledge of the direction of the prevailing winds will help to place them where they can be most effective in collecting the snow, which I consider as the real protection for young trees, orchard trees as well as forest trees, against the severity of our winters; fences, rails, branches, stones, any temporary obstacle that will arrest the snow will answer the purpose until the permanent hedges are ready to do their part.

I am now taking those precautions, for the purpose of sheltering the young walnuts transplanted last spring, and will make you acquainted with the results at our next annual meeting.

THE RED CEDAR AND OSIER WILLOW.

BY EDMUND HERSEY, HINGHAM, MASS.

Among the valuable trees that are indigenous to Eastern Massachusetts may be classed the Red Cedar. Few, if any, of our native trees possess so many points of excellence as this. It is valuable as a timber tree, highly ornamental as a shade tree, and surpassed by few trees or shrubs for a hedge when kept properly trimmed. It may

be trimmed so as to make a wind-break, or it may be kept low simply for an ornamental hedge. It possesses the important qualities of hardiness and freedom from destructive insects. It will grow not only on the rich intervals but also on the sandy plains or barren hill-tops, in the most sheltered nooks, and on the bluffs that are sprinkled by the ocean spray.

It is the opinion of too many, whose opportunities should have taught them better, that it requires nearly a century for a red cedar to grow from the seed large enough to make a fence-post, but there is abundant evidence to prove that it requires but from thirty to forty years for a tree to grow large enough to be worth for this purpose one dollar. As 500 trees can be grown on an acre of land, it is evident that on land that can be bought for ten dollars per acre it would be a profitable tree to grow, simply for posts.

The bright red color and the spicy odor of the heart-wood of this tree renders it very valuable for cabinet work, especially for chests or drawers in which to keep clothing from destruction by insects; but to grow trees for this purpose, like the black walnut, requires some years to ripen the wood after it has grown. To obtain lumber of a rich dark color requires from fifty to seventy-five years. The most profitable way to grow it for this purpose would undoubtedly be to permit not more than fifty trees to grow on an acre, and use the land for a pasture, as this number would not injure the feed but very little, if any, the red cedar being a tree which, on dry land, increases the amount of grass over which its shadow passes, and decreases it only on a very small space directly around the trunk of the tree.

Whenever division fences are to be made of wire, the red cedar will make one of the best line-posts of any tree we have. It grows upright, with a very straight trunk, shades but little, is of medium size, does not extend its roots to a great distance, and will grow well on a great variety of soils; all of which are desirable qualities in a line fence-post.

If farmers, when they put up a wire fence and attach it to posts such as are usually used, would set a small cedar tree between the posts, by the time the posts decay the trees would be large enough to attach the wires to them, thus making a very cheap fence that would last for generations, and when changes required its removal the trees could be utilized for lumber.

There are varieties of the red cedar which, when set in groups a few rods from the dwelling, possess a natural beauty which is not surpassed by any of our native trees. Without any effort to shape their form, there are varieties which will grow a perfect cone twenty to twenty-five feet high, and not more than six or eight feet in diameter at the base, the lower branches growing very closely to the ground.

The variety that will thus grow may be known when small by the cone form, fine branches, and bluish cast of the foliage. No doubt the want of the knowledge of how to select, when small, the right varieties of this tree for ornamental purposes, has kept it out of the list of trees most desirable for ornamenting public and private parks. The variety which has open branches, extending widely from the trunk, with foliage of light green color, is not desirable as an ornamental tree. The two varieties can be very easily distinguished when very small by those who have informed themselves of the difference between the two. The specimens which I here offer for your inspection show the two varieties; these are the extremes; they cross with each other and produce all shades between them.

For a hedge, the red cedar has the advantage of hardiness, beauty of form and color, and its wonderful power to adapt itself to any soil. It has been made to grow on a gravelly knoll, a sand hill, and in both a northern and a southern exposure; bears trimming very closely, and will grow so thick that a fly cannot pass through it, providing the variety with fine branches and blue cast of foliage be selected.

The red cedar ripens its seed in October and November, which should be gathered during the winter and planted as early in the spring as the frost leaves the surface of the ground. If sown on the surface of even grass land, and harrowed in with a heavy harrow, it will grow; or it may be sown in rows on ploughed land, covering lightly or just deep enough to keep the soil moist.

When small trees can be readily obtained, as they can in many towns in Eastern Massachusetts, several years may be gained by transplanting the young seedlings when six to eighteen inches in height. Trees growing in loamy land that is free from rocks and stones, can be more readily lifted without disturbing the roots from the soil that surrounds them than if they grow in a stony or gravelly soil. To properly lift a tree, a pointed shovel should be used to cut the sod and earth around it, cutting in a circle about the diameter of the height of the tree—the ball of earth, when carefully lifted with the tree, to be in the form of a bowl. For large plantations, or for hedges, trees not more than twelve inches in height should be selected. When not larger than this, and transplanted in cloudy weather, some time in the month of May, by one who

understands it, not more than two per cent. will fail to grow. When, in lifting, the roots of a tree separate from the soil that surrounds them, the tree should be at once rejected, as it is very difficult indeed to make a cedar, or, in fact, any other evergreen tree of any size above six inches in height, live when once the roots have been exposed to the light and air.

When only a few trees are to be removed but a short distance, with care, trees from two to three feet in height may be transplanted with success; but, as a rule, it is best to select trees less than twelve inches in height; then there will be but little, if any, check in their growth, providing the trees be selected, as they should be, growing singly in grass land, where they have had the unobstructed rays of the sun. Trees growing in the shade and trees which do not have limbs in vigorous condition growing close to the surface of the ground, should be rejected as unfit to transplant.

THE OSIER.

Very few who have attempted to cultivate this variety of willow have understood its characteristics, and so have failed to realize fully its value. Nearly every cultivator has attempted to grow it on moist, cold land, and has failed to obtain the best, or even satisfactory, results—it not being a tree that is adapted to low land, but grows naturally on high, warm land, where it makes a wonderful growth even when left to gather its substance from a thin, unfertilized soil. As it grows quite as well from cuttings as from roots, it is very easy to start a plantation. The cuttings, when set on good corn land, will make a growth of from two to four feet the first year. That the roots may become well established, the osiers should not be cut until the second year, when early in March they should be cut close to the ground. The first product is of but little value except for cuttings for new plantations. The following season the osiers will grow from four to nine feet in length, surpassing in quality the best imported European willow.

To give you an opportunity to examine and judge for yourselves how well this variety of willow will grow on very light land I have brought these specimens, which are the growth of the present season. The longest one measures nine feet and three and one-half inches in length, and less than one-half an inch in diameter at the large end, after the bark is taken off. The roots from which these were cut have been set about twenty years; the soil is a light, sandy loam, good mason sand being within a few feet of the surface. The land has never been cultivated or manured within many rods of where they grew until within three years; since then the land north of them has been plowed and a peach orchard set. The first year the land was manured with barn manure, the second year nothing was applied, and this year a few pounds of muriate of potash was applied to each peach tree; but no fertilizer was applied within ten feet of where the willows grow. When desired for basket-work, the osiers should be cut the next March after they have made one year's growth from roots more than two years old, and peeled as soon as the bark will readily slip. If not in a locality where they are wanted for basket-work, the osiers should be thinned out by cutting one-half of the smallest, and as soon as the leaves begin to show on the stems of those left uncut they should be removed by passing the thumb and finger from within a few inches of the top down to the ground, thus leaving only a tuft of leaves on the top, and preventing the growth of lateral branches. If the osiers thus stripped be permitted to grow two years longer they will be large enough for hoop poles, and being very smooth, straight, and of uniform size, they make one of the best materials for hoops for kegs and for binders for boxes in which merchandise is shipped.

Where there is a market for the willow for baskets and the method of peeling is understood, it is more profitable to cut every year for basket-work than to cut only once in three years for hoop poles; but in many localities it would be difficult to find men ready to buy the osiers for basket-work or to find those who understand the process of peeling them, though the process is very simple and requires but little time to learn it.

On good land three tons of peeled and dried osiers can be obtained from an acre, worth in the market $125 per ton. To peel the osiers by hand labor costs sixty dollars per ton, but by machinery much less, though as yet I have seen no machine that has been perfected which will do the work as well as it can be done by hand-labor; but no doubt there will be. A fair crop, on ordinary soil, is about one ton to the acre, thus giving a yearly profit of more than sixty dollars.

As the demand for osiers for basket-work is somewhat limited and confined to the cities, if very large quantities should be grown the market might be overstocked; but the demand for hoop poles is so large in all parts of the country that there is no probability that it will be overstocked for many years to come, and the profits for this purpose will exceed that of almost any crop which the farmer can grow.

In setting a plantation of willows, the land should be prepared by plowing and manuring as for Indian corn, and if it be grass-land it would be better to plant it one year to corn. The cuttings should be about twelve inches long, cut early in the season

before the sap starts, and set as soon as the ground will work easily; the cuttings should be set well down, so as to leave not more than two inches above ground, and on an angle of about forty-five degrees. If for basket-work, set in rows two feet apart each way; if for hoop poles, three feet each way. The land should be kept well pulverized the first two years, and the weeds and grass kept out, after which no further cultivation will be needed, as the crop will so shade the land that nothing else will grow. Unless the land be very poor, no manure will be needed after the first year; the leaves falling among the willows, which cover the ground so thickly as to prevent them from blowing away, gradually decay, and enrich the land the same as they do in a thick forest.

When the best methods of growing this tree or shrub are fully understood, a new and very profitable industry will be added to those which we now have.

SOME PRACTICAL HINTS ON TREE-RAISING.*

BY JOSEPH STORY FAY, WOOD'S HOLL, MASS.

There is a great attraction in watching the growth of trees. Children often plant peach or cherry-stones, apple-seeds or horse chestnuts for the sake of seeing them sprout and grow. There is no object in nature more generally admired than a thrifty tree. Then, too, there are many inducements to plant them. Like money at interest they grow while we sleep, and they are always a good investment. As the larger trees and finer timber are cut down, and the prices of lumber and wood in all their forms increase, we see a value in the smaller and more inferior ones, and realize the necessity of caring for them. On almost every farm and garden there are neglected corners and rough patches that are unused—too rough and stony to plow, too poor for pasture—where the spade cannot penetrate, but into which a tree-seed once planted sends down its roots and makes a home for itself. Nature is availing herself of these opportunities all the time, but the intelligent helper can hasten the work.

A good deal of labor is involved in the transplanting of a hundred trees, but little time is required to plant a hundred acorns, hickory-nuts, chestnuts, butter-nuts, beech-nuts, or black walnuts. It is necessary to put the seed away in fall for spring planting. Nature plants these various nuts or seeds in the fall, by dropping them among the fallen leaves in the little depressions of the earth, and there, if they were undisturbed, many would germinate and grow. But the mice and squirrels and worms devour many, while others fall under the trees, so that if they grow they are not in the right place and are shaded out. Thus but a small proportion of the seeds or nuts become trees. Mr. John Kenrick, of South Orleans, in this State, has made extensive tree-plantings, both of pine and of deciduous trees. The seed of the pine, protected by its shell, preserves its germinating power very well through the winter and can be planted in the spring. Acorns and the various nuts, unless cared for, dry up and mould and lose their vitality. To remedy this Mr. Kenrick puts his acorns or nuts, mixed with sand, or in layers, in a box or barrel, the bottom of which is bored full of holes. He then covers the top of the barrel or box with wire cloth to keep out rats and mice and, digging a hole in the earth, buries it five or six inches below the surface and covers it up. When the frost is out of the ground in the spring, he exhumes the box or barrel and finds all his acorns or nuts sprouted and ready to plant out. With a trowel they can be set just below the surface of any rough or stony ground, lightly covered, and they will grow with great certainty. Many hundreds can be planted in a day. This is a work that any one can do, and it is very practical and valuable. As we have said, now is the time to get the acorns or chestnuts or other nuts and to put them away for spring planting.

The fall would do equally well for planting but for the ravages of squirrels and mice. The seeds of the various kinds of pine and spruce do not require the same care. If kept in a dry place they will germinate without fail when sowed or planted in the spring. As most people know, these seeds are borne in a cone, which, when ripe, generally opens under the action of a sharp frost and the seeds fly out. Having wings, these are often carried to a considerable distance, and plant themselves in the open fields. After a cold, frosty day in autumn, with a strong northwest wind, the air to the leeward of a pine grove may be seen full of these flying seeds, and so the forests are enlarged. This is nature's process, and being very irregular, there are many parts of the open fields which are not seeded. The land-owner who wants to improve all waste or vacant space gathers the pine or spruce cones, dries them, and when they crack open shakes

*These notes have been written by the well-known pioneer of forest planting on the Massachusetts coast, and at his request find a proper place in this report.

out the seed and plants them in one of two methods. The first and simplest is, when there is a light fall of snow in the spring, to scatter the seed on the surface of the ground, so that it may be seen where it falls. Seeds are then not sown too thickly. The second method is either to plow shallow furrows about five feet apart, running around the hills rather than over them, following with a common vegetable seed-planter, or a man may, with a common corn-hoe, dig flat holes about four or five feet apart, a boy with a pail of seed passing along with him and dropping three or four in each hole. The man then flaps his hoe on the seed or treads his foot on it. Pine seeds need very slight covering. From six to eight acres can be planted in a day with a plowed furrow—three or four by the hoe. The work should be done as early in the spring as the frost will admit. Early planting does the best—that the seed may germinate before hot, dry weather sets in. If the season is very dry it may not all germinate the first season, and sometimes, when it does, the hot midsummer sun will wither it.

The method of broadcast sowing has been successfully practiced by me at Wood's Holl, while planting by the plow or hoe has been for the most part just as successfully carried on by Mr. John Kenrick, of South Orleans, and by others in the eastern part of Barnstable county. Perhaps the former method would be less laborious on very rough land. For the cape and the seashore the Scotch pine seems to have done the best in its vigorous and thrifty growth and its freedom from the insects and diseases which attack the native pitch pine. It makes a good shelter for other trees, but its value as timber or lumber has yet to be tested or its usefulness as a forest tree. It is, perhaps, too sappy and coarse-grained, but as a cover to oak or other deciduous trees in their early growth it is excellent and of undoubted use. The white pine does not do well where the salt wind touches it. It needs shelter on the coast, and so it is with the larch. For the interior the white pine is the most desirable, but probably the chestnut would pay better in the long run than any other tree. Pine seeds may be obtained of our principal seedsmen, who import them.

Much planting is done on a limited scale with trees raised in nurseries at the West, where, when the trees are six to twelve inches high, they are sold at about one cent each, but this requires more outlay of money at the start and more time and labor to do the work. Planting trees from the seed is like money put in savings banks and left to accumulate by compound interest. The land improves in value, as the crop grows, quite as rapidly as money is multiplied by the addition of interest, and probably more so. As the trees grow up from the seed they may be too near together, and from time to time will need thinning, and here will be found a supply of fuel which, in these days of open fireplaces, is always of value.

Mr. John M. Forbes, of Naushon, has fenced in this fall upwards of 300 acres of old pasture land on his island, which he proposes to plant in the coming spring with pine seed. It is well to remark that cattle and sheep should be kept off land thus planted, especially in the winter. Indeed, it is a well-accepted axiom that cattle should always be kept out of woodland, if it is to do its best.

"PRUNING THE FOREST."

BY B. E. FERNOW, OF NEW YORK CITY.

In a recent hearing of testimony before a committee appointed by the controller of the State of New York to investigate the needs of forestry in the Adirondack Mountains, it is reported that the lumbermen, besides laying all the blame of forest destruction and devastation of the hillsides to the ravages of fires, described their own operations as harmless and without any detriment to a continuance of forest growth; nay, some one advanced the cheering proposition that the lumberman was doing nothing but "pruning the forest." This most happy expression for the work which the axe and saw are performing in our forests has since been seized upon on all sides by those who have an object in shielding the operator of logging and saw-mill enterprises, representing them as benefactors rather than enemies of the forest.

We, on the other hand, can only consider the use of the term pruning, in this connection, as the grossest misapplication. "Pruning," derived from the French *provigner*, and closely allied to the verb "to propagate," means "to trim or lop off the *superfluous*," with the implied purpose of benefiting the remaining.

Now, not even a lumberman will nowadays maintain that he is removing from the forest only what is superfluous. From our statistics it would almost appear that we have not much of forest left that is superfluous, and if it is to apply to the single species which the lumberman finds it his duty to remove we would point out that the

superfluity of white oak, the most valuable hardwood, is not apparent anywhere; that the white pine has been removed in some regions—Pennsylvania notably—almost to the last stick; that the hemlock is following fast; that good ash growth is becoming so scarce in the North as "to make it too expensive to be commonly used for oars;" that the better qualities of walnut are commanding excessive prices; that, to sum up, the advancing prices of high grade and the diminished price of low grade lumber of any kind are a sure indication that the former grades are growing scarce and scarcer, and that the lower grades must be resorted to by the mills in order to keep them at work. We may agree, then, that the lumberman does not operate on waste and superfluous material, but that he takes the very best he can take hold of.

Now let us see whether the remainder is benefited. Taking the forest as a producer of valuable material we do not perceive that by leaving the inferior kinds and the inferior individuals of valuable kinds the aspect, after the lumbering, is improved.

The methods of lumbering now in vogue, necessitating the leaving of top ends and brush in the forest, increase the danger from fires to a greater extent than is even admitted. Often where the fire, under natural circumstances, would be confined to what is termed a "running fire," quickly consuming the fallen leaves without injury to the growth, the dry rubbish left, *when kindled*, will intensify the heat so as to damage and kill the standing timber.

As to any benefit to be expected from the present methods of lumbering in regard to a renewal of the forests, by allowing the aftergrowth and younger trees to fill up the gaps, this may be true with some species which are capable of sustaining the shade of the surrounding timber; but European experience of more than a century tends to prove that this method of renewal has rarely the desired effect, and resorting to it for the purposes of benefiting the forests can only be excused by the impossibility of applying other methods.

The last argument which the lumberman may advance to strengthen his position would be, that by not removing the entire forest cover from the surface he avoids interference with the meteorological and hydraulic influences of the forest with which he has been charged so extensively.

We are sorry that even on this point we cannot accept the defense.

Leaving aside the question whether the forests exercise the influence on the water supply of streams claimed for them, or on the amount and distribution of rainfall over adjacent fields, which is undeniable, we will here only compare the effects of the system of selection, as I will call the lumberman's operation, and of those systems which contemplate the simultaneous rejuvenation of the whole forest by natural or artificial reseeding or planting, which I will call timber forest.

That the amount of the atmospheric precipitations which reach the soil in the timber forest is larger—much larger than in the other case—does not allow of doubt. In the forest, resulting from the method of selection, soon the crowns of the old timber develop largely and denser as effect of the increased access of light, and the amount of evaporation from the increased foliage increases proportionately. Whatever of rain does not evaporate from the taller, densely foliaged trees drops onto the lower growth and there evaporates, so that of a slight rain either nothing reaches the ground or else so little that it soon evaporates from the moss and *humus* cover without penetrating. In the same way the snow reaches the soil in less amount, and, deposited on the lower growth, especially where the wind has no power to shake it off, it evaporates without increasing the moisture of the soil. This is especially the case in evergreens, and is the more detrimental as it is the hydrometeors of the winter which furnish the reserve of moisture to alleviate the summer droughts.

To this add that where the young growth is distributed through the forest in batches under the older timber, the temperature being higher on account of impeded circulation of the air, a greater amount of moisture is evaporated during the period of vegetation and the drying up of the soil thus accelerated.

In the timber forest not only a larger amount of meteoric precipitations reaches the soil, but the mould cover condenses and absorbs more moisture, when the colder more nearly saturated air enters the forest at night.

We abstain from adducing here a further accumulation of reasons which tend to condemn the system of selection from every standpoint of rational forestry.

We find nothing that will warrant this system as a benefit to the soil or the forest and its influences, except in the rarest cases in high mountain ranges, where the mechanical effects of the forest as barriers against avalanches and torrents must be maintained to the exclusion of all other considerations.

Do not let us hide the truth. The present system of lumbering is in every respect detrimental to a continuance of forest growth. It is *excusable only* on the plea that the lumber business is a legitimate business; that those who engage in it cannot be expected to care for more than immediate financial returns; that peculiar circum-

stances and conditions of this country have inaugurated the system in vogue, and that ignorance of better methods and the anticipated danger of losing valuable property by incendiarism will tend to continue it until conditions of lumber supply change, until better protection is offered, or until the Government itself steps in and protects those forests which it seems desirable to preserve in continuance.

The object of this paper originally had not been to expose so lengthily the mistaken idea of the lumberman's "pruning of the forest." It was rather to lay down the principles involved in the correct pruning of the forest. I do not allude to the pruning of forest trees individually—a subject I wish to discuss at some other time—but to the interlucation or thinning of growing forests, with the purpose of improving the remaining growth; a subject which is worthy of the whole attention of a beginning forest-grower, on which more has been said, and is being said at present in European forestry literature, than on any other; one which in this country seems to be little understood, and even in Europe, though thinning has been practiced for a long time, the opinions as to particulars are still divided.

As every question in forestal operations, so that of thinning or interlucation has to be considered from two points of view, the financial and the mere forestal. The object of interlucation being an increase of yearly accretion to the single individuals remaining, and thus an increase of the aggregate crop of wood, as is claimed, it is evident that if this primary object be attained the secondary, consequential one, of increased financial value will also be arrived at, if the operation either pays for itself at the time from the extracted material or if the cost, considered as a principal, with compound interest up to the time of clearing added, represents a sum smaller than the consequential increase in value of the remaining growth.

In this paper, however, it is not our intention to discuss the financial aspect of the question, but to explain the rules which should guide the forester in the operation and the principles upon which it rests.

First, let us consider what interlucation purposes to accomplish and what its effects are physiologically.

If we compare single specimens of trees grown in the full enjoyment of light along avenues and fields with their equals grown up in the density of the forest, other conditions being alike, we perceive, in ascertaining their yearly accretion, that whilst the former have in the same number of years attained a greater circumferential accretion, the latter excel in the length of their shafts. In dense, evenly-grown plantations the growth of height is favored at the cost of sidewise expansion of the crown and circumferential accretion. Under such conditions the stems attain a greater total height, longer, straighter, more cylindrical, and easily-splitting shafts, and thus make more valuable wood; but at the same time the single individual does not attain the same diameter and mass of wood as the isolated tree.

As the nourishment of the tree and the formation of wood is almost wholly dependent on the functions of the leaves, it is natural that the trees with the largest amount of foliage should make the most wood; and as, again, the functions of the leaves are dependent on the direct influence of the sunlight and are performed in proportion to the amount of direct light available; and, again, the amount of foliage itself is greatly dependent on this life-inciting influence of light, it is natural that those trees which enjoy the greatest amount of light make the most wood. Then, we find that the yearly circumferential accretion of trees, *ceteris paribus*, stands in direct proportion to the extent of their crown in breadth and height and to the mass of their foliage.

The first object of interlucation, then, is to give more light and room for the development of the crown to those specimens which we want to favor by removing others.

In this operation, as in all others of forestal management, the first requirement is a thorough knowledge of the laws which govern forest-growth (such as I have partly described in a paper read before the American Forestry Congress at Montreal). In this operation, above all others, the judgment of the forester and due consideration of all influences is called for, as, by a misapplication, serious injuries may be inflicted upon a promising growth.

We may here shortly repeat that the greater amount of their food, the carbon, is derived by the trees from the carbonic acid of the air through assimilation by the leaves; that the chemical constitution of the soil is almost irrelevant; that the office of the soil is mainly to furnish the great bulk of the water, of which almost fifty per cent. enters into the composition of the wood. It is, therefore, the *physical* properties of the soil which are of the greatest importance, above all its humidity influenced by different degrees of depth and looseness, nature of subsoil, surface-covering, and its humosity (depth of vegetable mold), which tends to mitigate extremes of these properties, and is, therefore, a most desirable accessory to a forest soil. The formation of this *humus*, or vegetable mold, from decaying leaves is favored, as well as the

necessary humidity of the soil preserved, by absence of the drying effects of sun and winds.

For the forest cultivator, then, the whole problem of forestry lies in this precept: "that his principal effort must be directed to the conservation and increase of the 'soil-quality,' calling all the requisites just cited by one word, since upon it depends the productivity of the forest, and this can only be done by depriving as little as possible any portion of the soil of the protecting cover of the crowns."

We have, then, in our thinning to balance the requirements of a careful forestry for continuancy and the desire to promote the accretion of the individual components of the forest, and to take care that, whilst we try to gain an advantage for the present, we do not do so at the expense of the future.

We see in any young growth from an early age a natural thinning out going on, when those parts of a tree which are shut out from a sufficient enjoyment of light die off, and some trees, in the struggle of life, gaining supremacy, exclude from this necessary factor of existence and shade out their neighbors. In this respect we may group the trees of a forest, as regards their access to light, into two classes:

1. The foregrown; which might be graded again into
   - *a*, predominant;
   - *b*, codominant, and
   - *c*, followers.
2. The overgrown; with the grades of—
   - *d*, overshadowed;
   - *e*, suppressed.

We imitate, assist, anticipate nature in this process by interlucations; and according to the grades into which we extend our cutting, we speak of a dark interlucation, in which only the suppressed, dead, or dying stems are removed; a moderate one, which takes all the overgrown, and a strong one, which attacks even the last grades of the foregrown and interrupts somewhat the upper crown-cover.

The degree of the thinning depends greatly on the soil and the exposure. In accordance with the rule given above in regard to the conservation of the soil-quality a dark interlucation only is in most cases permissible and sufficient. The necessity of a stronger interlucation offers itself in a growth with an unusually large number of stems of uniform calibre, where sometimes the struggle for supremacy is unduly prolonged and the extraction of overstock is needed to assist the development of larger dimensions. Predominant stems ought only to be taken exceptionally, when a more valuable kind which we want to favor—as, for instance, white oak—is threatened to be overwhelmed by a less valuable overgrowing neighbor, or when, on account of some peculiarities of a foregrown kind, detrimental consequences must be anticipated, as, for instance, when the birch (which only too easily finds entrance into our plantations), with its whipping branches, may injure and strip the young buds of the pine or fir.

A deep, rich soil, with abundant moisture, on north and northeastern exposure, will suffer a strong interlucation with less injury, because the vigorous growth due to its favorable conditions will soonest close any gaps in the crown-cover. On the other hand it will be almost always well to leave even subdued stems on thin and dry soils and such exposures, where, by their removal, entrance is given to drying winds.

The degree of thinning depends also a great deal on the species forming the forest. On a former occasion I have pointed out the importance of a classification of the different species, with reference to their relation towards light and shade, in shade-loving, light-enduring, and light-needing. This classification has some bearing on the degree of interlucation. Those kinds which, for their development, require a larger amount of light would naturally show in a dense growth a greater amount of suppressed stems, and consequently a stronger interlucation would be indicated. On the other hand, these very species are those which are least capable of preserving the soil-quality, because their naturally thin foliage not only does little toward the increase of the layer of *humus*, but does not efficiently exclude the rays of the sun, especially as they have the tendency with increasing age to thin out by themselves. They are, therefore, the most difficult to manage, and the continuity of their crowns must be most carefully preserved.

The time when the first thinning should take place is generally determined by the possibility of marketing the extracted material at a price which will cover at least the expense of the operation. This is, however, not always possible; and the consideration of the increase in value of the remaining growth, or rather of the detriment to the same by omission of timely thinning, may then be conclusive.

On good soil and on mild exposures interlucation may take place earliest, because here the growth is ranker, and a difference in the development of the different stems is

sooner noticeable. Light-needing and quick-growing kinds offer a similar aspect to those grown on *good* soil; and here, therefore, early thinnings are indicated. In these cases the thinnings have also to be repeated oftenest, especially during the period of prevalent height accretion.

Absolute rules as to the time for interlucations and their periodical reiteration can evidently not be given; the peculiar conditions of each individual case alone can determine this.

The golden rule, however, is: Early, often, moderately.

The right time for the beginning of these regular and periodical interlucations is generally considered to have arrived when the natural thinning out, mentioned before, commences and shows the need of the operation. But it may be urged that the density of the growth before its maximum, evinced by the dying of some parts, would present an optimum for the most advantageous development, which it would be wise to maintain. This optimum would be different for different localities and conditions, and its evidence will be difficult to determine; at present, at least, the data for the determination are still lacking.

Different from these interlucations, which begin, say, at the fifteenth year of the growth, the need and value of which for the better development of dimension timber is now generally recognized, are the thinnings during the earlier stages of the growth. Here we touch the realm of controversy and unfinished history of a theory which just in our time strives after completion by gathering experimental and statistical data which up to this time were lacking.

It may be of interest to review briefly the history of the theory of interlucation in Germany.

Since the middle of last century thinning out of older growths was known and practiced, but it was rather the economic utilization of those trees that had succumbed in the struggle for supremacy—not the shortening and determination of the crisis—which recommended the measure. The theory of the promotion of the remaining growth by means of interlucations was only developed in 1802; but though von Cotta, one of the old masters of forestry, recommended this measure as a means of education from the earliest stages of the growth, the practice, even until to-day, has been reluctant to accept it so broadly—partly because the extracted material did not find a ready market—partly because the dangers to the preservation of the soil-quality by this early interference seemed too great and the effect of the measure in the end too uncertain.

Cotta recommended these thinnings as a means of accelerating the growth to begin when the most dangerous period of young plant-life and all fear of injuries by frost or heat was removed, then to take away those stems which had fallen behind, and allow to remain only as many "as could grow without injury or interfering with each other; the branches should touch, but not interlock." These "cleanings" were to be repeated as often as the plants impeded each other's growth. The practice confines these early extractions to the removal of inferior and injurious kinds, to extraordinarily dense growths and poor soils, where the development of predominant stems is retarded too long.

Lately, however, the necessity of a more energetic advancement of dimension timber has raised the question of educational forestry again, and though no definite answer may be expected in the near future, the necessary experiments have been instituted to determine the effect of thinnings on the remaining growth as well as on the soil-quality.

In conclusion I may mention two methods which are growing more and more in favor for the production of dimension timber—the so-called "modified timber forest," in which at the age of seventy to eighty years—*i. e.*, when the height accretion is mostly completed—the number of stems is gradually, with a view of seeding the ground, reduced to such an extent that the continuity of crowns may be expected to be re-established in thirty to forty years, during which time the trees have had a full enjoyment of light inducive to circumferential accretion. To counteract the detriment of thus laying bare the soil the eventual undergrowth of young beeches is repleted by sowing or planting different shade-enduring species, which soon cover the ground.

The other method found its origin in the peculiarity of some light-needing species, which in unmixed forests cannot attain the most valuable age and size without thinning out by themselves, and which, without soil cover, are liable to deterioration themselves as well as to allow the soil to deteriorate. To prevent this the inferior individuals are removed and a soil cover created by sowing or planting species which will endure the shade of the foregrown forest. The oak especially is thus undergrown with beech.

From the foregoing remarks on the principles of interlucation, it will have appeared that many important questions of forestry are still in the field of controversy; that

forestry, though practiced abroad for centuries, is by no means an abstract and finished science, but, depending largely on the development of natural sciences, has, like those, only of late taken a more progressive start. Its progress is, besides, so much slower than that of any other science, because the answers to many of its questions and experiments are given only in decades and centuries; and, therefore, were even the time when necessity demands attention to this subject in this country further removed than it seems to be, it would be wise and provident to prepare for the coming need without delay.

LUMBERMAN'S WASTE AS A FERTILIZER.

BY B. E. FERNOW, OF NEW YORK CITY.

When we assert that there exists an undeniable relation between agriculture and forestry, our thoughts at once are led to the discussions on the mitigating influence of forests on the surrounding climate, their equalizing effect on the distribution and amount of meteoric precipitations. We may also think of the employment which the wood-lot gives during the winter to unemployed rural labor.

But it may be that besides these benefits, accruing from natural conditions, a more immediate and tangible interdependence might be established which would benefit the two economies.

Such relation has existed for some time in the European countries, but to the detriment of agriculture as well as forestry, while it was maintained as affording relief at least to the former.

The practice of using the fallen foliage for bedding and manuring purposes largely prevailing in the poorer agricultural regions of Germany, whilst it has impoverished to ruin large areas of timber forest, has not in the same degree benefited agriculture; it has tended to deteriorate the already slovenly management of the small tenant, who, unable to feed stock, sold his straw, whilst using the easily-appropriated gift of the forest with minimum fertilizing qualities.

The effect of withdrawing the foliage covering from the forest soil, which forms its most potent protection against drying influences of sun and wind and against extreme changes of soil temperature, and which presents the best and only fertilizer of the forest, has shown itself in diminished growth, difficulty of rejuvenation, disappearance of more fastidious species, and at last total devastation of forest areas. In the following notes I wish to indicate only, how a reciprocal, beneficial relation between the farmer, the lumberman, and the forester might be established, which, while furnishing a desirable fertilizer to the one, will help the other pay his expenses without experiencing the objections of the third.

The use of sawdust for bedding purposes has long been known. I read in a German agricultural authority of 1853: "That sawdust, like straw, may be used for humification, need not be specially proved, since it substantially contains the same elements as straw, only its decomposition is slower, and it should, therefore, be mixed with substances facilitating decomposition, like the liquid and solid excrements of cattle."

But the proposition is now made not only to extend the use of sawdust, but to prepare a material for bedding and manuring purposes by disintegrating the inferior dimensions and brushwood left in the woods, generally called lumberman's waste.

If this could be done in a practical manner on an extended scale the advantages to the farmer as well as to the lumberman would be immense. The vexatious question of the lumberman's leavings would be largely disposed of, and the additional receipts from the hitherto unprofitable product would enable the lumberman to look with more equanimity at the demands of the foresters.

That agriculture would welcome such a cheap fertilizer, especially in the Eastern States—in fact is in great need of some such manuring material—may be estimated from the yearly-increasing number of worn-out farms and from such statements as I read in agricultural reports: "That, after all, for a permanently-improved condition of the farm, we must rely upon old-fashioned, barn-yard manure as against the volatile, short-lived commercial fertilizers," or "that the best yields are reported from mixtures of mineral fertilizers with barn-yard manure."

To bring about such a happy solution of two difficulties we will have to show whether a practical, inexpensive method of preparing and shipping wood-litter can be devised for the lumberman, and whether the mechanical and chemical properties of such wood-litter, compared with the price, will recommend it to the farmer. I am aware that sawdust has been recommended for manuring purposes and condemned, but I cannot find any convincing proofs that such objection is more than an assertion based on a misapplication of this material.

It is, on the other hand, asserted, upon experiments on an extensive scale—

1. That wood-litter furnishes a better, especially cleaner, *bedding* for cattle than straw; the liquids are at once absorbed and the dry excrements are quickly enveloped with wood fibre, preventing soiling of the cattle. The cleaning of cows requires only about one-quarter the time it does where straw is used. The removal of the bedding requires less time, as only parts of it need be changed. The air of the stables is less damp, and kept purer in consequence of total absorption of all moisture and slower decomposition of the urine, which, especially in horse-stables, where ammonia is quickly formed, seems to be of importance, and a guard against sore eyes and other diseases.

2. That the *manure* from wood-litter is better than from straw, because it binds better, especially the liquid excrements, and retards the decomposition and loss of valuable plant-food, especially the nitrogenous compounds. The mechanical effect on the soil is said to be in no way inferior to that of straw manure. That humification of wood manure goes on more slowly cannot be denied, but this may often prove an additional benefit, when the process of decomposition takes place in the soil instead of on the manure heap, and the soil profits from the heat due to the chemical action and retains the ammonia developed.

As the testimony of European experience, from which the above conclusions were drawn, may not be acceptable to you, I have tried to get some on this side of the water. My opportunity has not been very large. I find, however, specific testimony before the Ontario Agricultural Commission, in 1881, charged with ascertaining the practice and possibilities of agriculture in the province.

Says Mr. Matheson, of Perth:

"I do not use any straw for bedding; sawdust is the cheapest thing I can get for the purpose, and it soaks everything up, increases the bulk of the manure, and makes its quality very fine. One load of this manure is equal to two or three loads of what I formerly turned out. I have had from it 500 bushels of roots (turnips, mangolds, carrots, and sugar beets) to the acre."

Mr. Benson, of Cardinal, says:

"I bed my cattle on sawdust, which is an absorbent and makes a vast pile of manure. The sawdust I use is not common sawdust from a saw-mill, but the shavings and sawdust of seasoned lumber from a stave and box factory; the lumber is kiln-dried. The sawdust, therefore, absorbs all the moisture that comes from the cattle more rapidly than straw. I never use pine or cedar sawdust, because it is difficult to rot; but I confine myself to basswood and elm, which decompose quickly. Very few people have equal facilities for getting such a pile of manure from such good material."

These experiences have been with sawdust; but our proposition is to use a litter made of disintegrated brushwood, which would greatly surpass the former. The more fibrous condition of such material would augment its absorbing capacity; besides, those parts of the tree contain in larger amount the important plant-food which we desire in a manure.

I find, from analyses of Wolff & Stoeckhard, in 1,000 parts of air-dried substance—

	Potash.	Phos. acid.	Nitrogen.
Rye straw, containing	8.6	2.5	4
Spruce litter, containing	7.4	3	6
Wheat straw, containing	6.3	2.2	4.8

Taking four, nine, and twenty cents as the price of the ingredients, respectively, the mere intrinsic fertilizing value of the straw would average $2.78 per ton, whilst the wood-litter figures at $3.53 per ton.

This would show the wood-litter by twenty-seven per cent. superior to straw as a fertilizer. But in both materials their mechanical properties are the most essential, and these appear to be more favorable in wood-litter, unless it should be found that the amount of tannin in the bark is sufficient to act injuriously on the valuable plant-food contained in the excrements and on the crops, which has been denied.

To make a comparison between the fertilizing and the feeding value of straw sufficient data are still absent, but it is apparent that a considerable gain must accrue to the economy of the farmer who can extract from his straw the animal food before it goes into the manure heap. I see it stated in a German paper that whilst the value of plant-food in straw is equal to three dollars, the value of animal food is equal to $8.40 per ton (straw selling at twenty dollars). But those figures cannot be applied to our circumstances here, though they would lead us to believe that the value of straw for fodder exceeds its fertilizing value, and that even at ten dollars per ton we pay a considerable amount for its bedding value, which may give an acceptable margin for the preparation of a wood-litter.

The other side of the question, namely, the practicability of preparing this material, I regret not to be able to present as fully and convincingly as the advisability of using it.

At first sight the difficulties of manipulation would seem to indicate a financial impossibility, yet I have faith in American ingenuity to overcome such difficulties and to devise economical methods as soon as it can be demonstrated beyond doubt that a valuable material with an almost unlimited market may be produced out of waste.

If it is possible to manufacture and ship over a distance of more than 300 miles charcoal at a price of six dollars per ton, or to haul bark for fifteen to twenty miles at four to five dollars per ton, I cannot see any practical objection to handling the leavings as economically, and, when an eight-horse power ore-breaker reduces two tons of ore per hour, why an economical preparation of wood-litter should not be possible.

From the scant experiments made in Germany not sufficient data could be gathered to make practical inferences for this country. A factory in Hesse offers pine-litter in bales at $4.50 per ton, which is half-price of straw. A disintegrator of Carter's, in England, is said to be a good producer, but the quality of material was not acceptable. A machine, of German invention, with automatic feeder, which promises to use up any brushwood up to one and three-fourths inches in diameter, full length, requires five to six horse power to make three tons per day; first cost, without motor, $135.

It is probable that a division of the operation into several stages will be most advantageous and allow a more extensive use as to sizes of raw material. I should propose the employment of a cutter preparatory to the disintegrator.

Shortly before finishing this paper I find that in New York city a planing-mill has at work a machine, consisting of two cylinders with rows of cutting-teeth, revolving in opposite directions, which grind the shavings coming from the planer to suitable meal.

This material is sold in bags containing thirty-five pounds each, at one dollar per bag, or $5.70 per ton. This factory sells about five tons daily, whilst other factories, selling unground shavings, may double this amount of daily use.

My friend, Mr. Hicks, of Roslyn, tells me that he and his neighbors have been using the sawdust from his mill for years, at five dollars per ton, to their entire satisfaction in the stable and on the field.

There seems, then, a fair prospect of utilizing the inferior material left now to waste by the lumberman, and the importance of the problem to both agriculture and forestry should be sufficient to invite close investigation without prejudice. Regretting that I have not been able to present more fully the experiences thus far had on the subject, I would hand over the suggestion to experimenters and inventors.

Mr. C. M. Hovey, the well-known nurseryman of Cambridge, favored the Congress with a list comprising one hundred and fifty forest and ornamental trees, growing in his grounds, planted by himself from 1840 to 1860, the trees being now from twenty-five to forty-five years old and from fifteen to sixty feet high.

As the age of the several trees and the conditions of growth were not given a reproduction of the list here would not be specially serviceable to the interests of forestry.

FOREST ENTOMOLOGY.

BY E. B. SOUTHWICK, OF NEW YORK.

Prof. Southwick interested the congress by a finely-prepared exhibit of forest botany and forest entomology, and in a short paper pointed out the necessity of studying the nature, causes of phenomenal increase, and means for arresting the depredations of the host of forest enemies represented by the insect world, for the development of which the removal of natural forest-growth, artificial drainage, and artificial forest-planting prepares more favorable conditions from year to year.

RELATION OF FORESTS TO FLOODS.*

BY THOMAS P. ROBERTS, PITTSBURGH, PA.

When, at the request of the Secretary of the American Forestry Congress, I promised to prepare a paper on the subject of the destruction of forests as affecting the floods of our great rivers, I confidently relied upon finding ample time at my disposal. So, now, after having been an almost incessant traveler for several weeks, and but a few days left before the convention, I hesitate to lay before so distinguished a body my hastily prepared contribution; and I would not do so if I did not realize that meteorology and the kindred department of sciences into which your discussions naturally drift, are progressive—that no writer is expected to exhaust them, and that errors are pardonable.

Your estimable Secretary in his note intimated that as I had read a paper last year bearing on this subject before the Engineers' Society of Western Pennsylvania, in which he thought I had antagonized the views of the great majority of the friends of tree culture, an excellent opportunity would be now offered for a larger hearing and more animated discussions.

I accepted the intimation as a kind warning. There is one minority man on scientific subjects still living—the Rev. Jasper, of the Baptist church in Richmond, Va. He also was invited to discuss his views before an adversely thinking audience. Nevertheless, the newspapers report that the "jury" decided he was right, and "Dat de sun do move around the earth."

But the pre-eminence of being "alone with your views" is a most undesirable position, and the pride it could engender could affect only peculiar minds.

But I will hasten to say that I have said nothing nor advanced any ideas which can be used to refute the arguments in favor of forestal laws and regulations. I have simply taken the ground that the destruction of forests from the light of records, both in this country and in Europe, has had no appreciable effect in increasing the height and frequency of our great river floods.

The phenomena of the discharge of rivers vary greatly in different parts of the world according to the areas of their valleys, geographical positions, mean altitude, rain-fall, climate, and the flora of the region which they traverse. Their low-water discharges are the most interesting and important as bearing upon the question under discussion, and I desire now to remark that I have and will confine my statement to *rivers*, which must be distinguished as under more widespread and prevailing natural laws than apply to springs, brooks, and creeks. Creeks and brooks are affected by every passing shower or storm-cloud, and *I will not undertake to deny that the conservation of the rain-fall in such local districts is aided by forests;* but I must distinguish between local rains and general storms, and between summer, fall, winter, and spring floods. Rivers draining five thousand square miles or upwards, so far as I know of them in the interior of the United States, are not appreciably increased in their low-water discharge by local storms. Even the disastrous cloud-burst of July 9th, 1874, which desolated Allegheny city and parts of Pittsburgh, sweeping down Butcher's Run, covering the lamp-posts in the streets, occupying the narrow defile of the water-course, washing away buildings, and drowning over two hundred people, was scarcely noticeable in the waters of the Allegheny and Ohio rivers, into which it poured. Such storms are rare, indeed, and nearly always develop upon a narrow pathway seldom exceeding a mile in width; so that when we come to consider

---

*This elaborate and valuable paper, for which the Congress is indebted to Mr. Roberts, was presented at the Boston meeting, but not read on account of the absence of the author and the lack of time for its discussion. By placing it in this report the Congress does in no way indorse the views of the author, but gives opportunity to prepare—as so technical a paper demands and deserves—a discussion of his conclusions at the next meeting.

While the paper shows, at least, that the question of foreign influences, scientifically speaking, appears still an open one, the empirist has a right to his theory, based on historical and seemingly logical inferences, even if the scientist cannot explain the phenomena of cause and effect satisfactorily to himself. Meanwhile, German investigators have set to work systematically to determine by scientific methods the numerical influence of forests on temperature and rain-fall, and conclusions have been arrived at greatly at variance with the ideas advanced in this paper.

great areas drained by rivers, and construct diagrams of their annual low-water records, we need not be surprised at their comparative uniformity year after year.

A river of large drainage area is made up, to be sure, from a multitude of tributaries. Over an area of 20,000 square miles, which is the basin of the Ohio at Pittsburgh, there are, even in the seasons of the most protracted droughts, almost daily thunder storms, of limited area, perhaps, but each deluging in turn one or more of the minor tributary valleys and causing local freshets. No rain-fall may be observed at any designated station for two or more weeks at a time; nevertheless the river represents the aggregate of their effect, its low-water discharge being in reality made up of numerous miniature freshets. In other words, I argue that the low-water discharge of the Ohio river is to a very great extent maintained by a circulating series of minor freshets. A dry-weather spring yielding two gallons of water per minute, making seventy-five barrels daily, would be accounted enough even for the maintenance of a large stock farm.

The lowest stage of water ever known upon the upper Ohio was in 1838, when for several days the least discharge of the river was 552,000 gallons per minute, to maintain which it would require the united tribute of 276,000 such springs. For the average season of drought it would require more than 500,000 such springs to maintain the low-water discharge of the Ohio river.

On the other hand it would require that only ninety-seven square miles of the entire territory of 20,000 square miles be daily visited with a storm yielding for discharge a little over half an inch of rain-fall.

These figures are presented merely to set forth very briefly how great rivers may maintain their low-water discharge. I am persuaded that if absolutely no rains visited the Ohio valley for several weeks at a time during the summer, the river would literally dry up, for I have no faith that the perennial springs of the forests, supposing the region were a virgin forest, would support the loss due from evaporation in the long, wide, and shallow pools which exist in the main water-course. Therefore it matters little if the "saw-mill" man's creek has been dried up by the denudation of forests; the river will preserve its constant average. Occasionally the saw-mill creek may burst its banks, rising possibly more suddenly and higher than before its banks were denuded; the river accepts it as just one of those "ninety-seven square-mile floods" due for one day.

I myself know of many streams where saw-mills have been abandoned on account of the increasing irregularity of the seasons during which they could be operated, and I attribute the cause to the wholesale and wanton destruction of the timber; but in saying this I will not admit that such destruction of the timber has any appreciable effect upon the rain-fall or climate of the regions in question. So far as I have read the writers dwelling upon this intricate subject advance only theories, unsupported by statistics. I may be in error, through ignorance, regarding this matter, but I have thought it strange that with so many writers upon a popular subject none of them, which have fallen under my observation, excepting the German engineer, Gustav Wex, have attempted to prove *by records* that the river floods are higher and the rain-falls less and more fitful than formerly, either in this country or Europe, following the destruction of forests.

I will venture to quote from an anonymous writer, the author of a series of articles on "Forests and Forestry" recently published in "Forest and Stream:"

"The asserted influence of forest clearance in determining irregularities in river flow has long been transferred from the region of speculation to that of exact science. European nations plant forests for the express purpose of regulating river flow, with as full confidence in the result as the farmer feels when he drains a swampy meadow. The Swiss government has just made a large appropriation for this object. We have not merely the evidence that wholesale forest clearance is invariably followed by irregularity of flow in all the streams and rivers of the region, exhibiting destructive floods at one season, followed by dry beds or a sluggish flow at another season, but we have the positive evidence afforded by the reafforesting of the slopes bordering the Rhone and other European rivers, that with the growth of the forests the rivers are restored to their original regularity of flow, and the fact of the supposed connection having been thus demonstrated by experience, the mode in which forests exert their influence in this direction has been investigated and rendered familiar to all who have made the subject their study."

The writer of the above, I am inclined to think, has not consulted the official records of the German and French engineers, upon whom has devolved the care and improvement of the navigable streams of their respective countries.

Mr. Wex, the German engineer referred to, strangely enough, published tables exhibiting flood records, hereafter discussed, in support of his views that the destruction

of forests was causing lower water in summer and more destructive winter and spring floods in these rivers.

Unknown to me at the time I prepared my first paper, previously alluded to, his arguments, even from his own data, had been quite severely handled by his fellow-engineers, and I might have drawn from the highest professional authority additional data in support of my own conclusions.

Allow me to briefly state some of the conclusions I drew at the time of first reading Mr. Wex's book.*

The Rhine—Period 1770 *to* 1835.—Mr. Wex divides the sixty-six years into two periods of thirty-three years each, and finds that the mean height of floods in the second period has increased .086 of a foot, or about one inch. It is unfortunate for his theory in this instance that the individual highest flood, viz., that of 1799, when the Rhine rose to the twenty-five foot mark, was in the first period.

The Elbe—1728 *to* 1869.—As far as experience on the Elbe is concerned it appears to have been proved that the floods in this country have twice exceeded the highest waters recorded previously, viz: in 1845, nine inches, and in 1862 six inches higher than the flood of 1785. During the first half of this long period of 141 years twenty-two floods reached to or exceeded the seventeen-foot mark, and during the second half twenty-three floods reached or exceeded the same horizon. Nature's division, I thought, was remarkably even.

The Vistula—1809 *to* 1878.—In 1858, or three years after the disastrous flood of 1855 on the Vistula, Mr. Schmid, royal Prussian privy counsellor, published detail records of the fluctuations of the Vistula at Kurzebrack during a period of forty-eight years, from 1809 to 1856, inclusive, and gives the opinion 'that the apprehensions which were created in the country by the extraordinary flood of 1855, that larger quantities of water flow into the Vistula during recent than former years, are not well grounded, and that the tables rather indicate that a decrease in the quantities and stages of the water may have taken place.'

Mr. Wex then takes up the subject and supplements the tables by the records to 1878. He divides the sixty-three years into two nearly equal periods. Taking his own diagram we discover that in the first period of thirty-two years the river on nine occasions rose above the twenty-foot mark, and that once in 1829 it reached twenty-four feet. In the second period it rose also nine times above the twenty-foot mark, but at no time did it reach twenty-four feet, except during the extraordinary flood of 1855, when it rose to 28.5 feet; but, even with this unusual rise included, the mean of high water in the second period is not by one inch as high as the mean of the first period.

But Mr. Wex differs from Mr. Schmid, for he says: 'A much larger quantity of waters flow into the Vistula, and these now produce more numerous, higher, and consequently more destructive, floods than in former times.' Mr. Wex probably does not desire to be considered as an alarmist, but I think he reached this conclusion from a misapprehension of his own records.

The Danube at Vienna—1826 *to* 1874.—Mr. Wex presents the records of the Danube at Vienna from 1826 to 1874, inclusive. Dividing this into two equal periods I find that during the first, ten floods exceeded eight feet and include several produced by ice gorges. The highest rose to 9′ 3″, and the mean of the high water was 7′ 9.37″.

During the second period only six floods exceeded eight feet, but two of them were exceptionally high, one rising to 12′ 2″ and the other to eleven feet, notwithstanding which the mean height of floods for this period was over nine inches lower than for the first period.

Ice gorges are, Mr. Wex says, very frequent on the unimproved portions of the Danube above Vienna, and these exceptional floods, one of which occurred on February 5, 1862, and the other January 21, ——, were possibly augmented by them. A gorge breaks sometimes and acts like a broken dam in creating a pulsation which every gauge below will record merely as a passing flood. In searching the records of the Vienna floods, I find that of the fourteen summer floods during the 1826–42 period, when rains would have most to do with them, the highest rise was 9′ 3″, and that three of the fourteen exceeded nine feet. During the second period there were sixteen summer floods, one of them being 9′ 5″, and none of the other fifteen floods reached so much as nine feet.

Mr. Wex says: "The seven hydrotechnical experts who were invited by the Commission on the improvement of the Danube to give an opinion on this matter did not

* English translation by the late General Godfrey Weitzel, published by the Engineers' Department, U. S. A.

consider that the decrease in the annual discharge of the Danube at Vienna mentioned by me as yet a clearly-proven fact."

No one can question Mr. Wex's candor and honesty. Nevertheless he is the "lone man with his theory" among the engineers, both of this country and Europe.

The Danube at Orsova—1840 *to* 1871.—Mr. Wex's diagram of the floods of the Danube at Orsova is very unfortunate for his theories. Divided into two equal periods it is shown that in the first there were eight floods exceeding fifteen feet, two of which rose to nineteen feet. In the second period there were also eight floods exceeding fifteen feet, but none of them exceeded 17 feet 9 inches. The mean of flood-height was in the second period one foot lower than in the first period.

The Oder—1778 *to* 1835.—Lastly, Mr. Wex tabulates the record of the Oder river at Kustrin, but does not speak at length upon it. The annual records extend from 1778 to 1835, divided into two equal periods of twenty-nine years each. During the first period eleven floods exceeded ten feet rise, one of which was 13.8 feet and another 15.6 feet; but during the second period there were only six floods exceeding ten feet, and the highest individual flood rose to only 13.4 feet. Mr. Wex certainly took no mean advantage of silence, nor did he commit the "sin of omission" in this case.

The above, in brief, is the substance of Mr. Wex's patient researches, and he certainly deserves great credit for placing in convenient form extremely valuable data to refute the arguments of the essayists who so confidently assert that the floods upon the European rivers are increasing in height and frequency.

As a matter of interest, in connection with the European river record, I may be pardoned in quoting from the discussion in our Engineer's Society at Pittsburgh, the language at length of one of our most talented members, Mr. C. L. Strobel, C. E. M. E.

"The particular point of Mr. Roberts' paper seems to be this: That the cutting down of forests, which has been going on so extensively for a century or so, has not resulted in higher floods than were formerly known; his statistics show this. For a number of years our newspapers have been calling attention to the importance of maintaining our forests, a society has been formed to promote forest-culture, and Congress has taken measures in this direction. The chief argument has been that forests prevent the occurrence of very high and very low stages of water in our rivers, and that unless steps are taken to protect our trees from the rapid destruction now going on the country will periodically be affected with devastating floods and scarceley less disastrous droughts. Now. it seems to me there is nothing to prove that such will be the case, and much more to show that such results need not be expected.

"Mr. Roberts' interesting paper is a valuable contribution in this direction. Mr. Wex is, I believe, considered one of the strongest exponents of the forest theory, and I think Mr. Roberts has shown that he does not prove what he asserts. Wex's book has been severely criticized in other quarters and his own statistics used to refute the theories he advances. This has been done by a German writer named Herrich, in the proceedings of the Hungarian Society of Architects and Engineers, a resumé of which can be found in the proceedings of the Society of Architects and Engineers of Hanover for 1876, from which I have extracted the following notes:

"'Herrich shows that this subject has received much attention, in France particularly; that Wex's theories are old, but have not been generally shared by the most competent students of the subject. As regards the theory that the destruction of forests has increased the high waters of rivers, the flood records of the Seine are cited, which are authentic and very complete. They show a gradual lowering of the high-water mark much more pronounced than the cases cited by Mr. Roberts, as will be seen from the following:

	Year 1615. Meters.	1649. Meters.	1651. Meters.	1751. Meters.	1799. Meters.	1807. Meters.	1850. Meters.
High water	9.14	7.65	7.85	6.70	6.97	6.66	6.07

"This is a gradual lowering of the highest flood-marks of this river of three meters in 235 years. Mr. Roberts in his paper treats of only one of Mr. Wex's theories, viz., the effect of forests upon the high and low water stage of rivers and streams. Wex does not rest his case here. He also claims that forests induce atmospheric precipitation so as to increase the amount of rain-fall, and further, that they bring about a more equable temperature by moderating the extreme cold of the winter. Herrich shows that proof is lacking for these theories also, and that rather the reverse appears to have taken place. As regards the rain-fall Monesthier Savignat, a defender of forest-culture, and Volles, an opponent, both concur that an increase of atmospheric precipitation has taken place in France, the average for the last century being 480 to 550 millimeters and for the present century 560 to 620 millimeters, and Flanguerges states

the rain-fall at Verviers for the last century to have been 842 to 899 millimeters and for the present 926 to 1,012 millimeters. We have, therefore, here also the direct opposite of the result claimed by Mr. Wex."

FLOODS ON THE OHIO RIVER.

The great and disastrous floods on the Ohio river of 1883 and 1884, having exceeded in height all previous records, naturally attracted wide-spread attention, and we find them sometimes alluded to in support of the theory that the destruction of forests increases the height of floods.

The writer was in the service of the Government as an assistant engineer on the improvement of this river for a number of years, so that the phenomena attendant upon its floods has, since 1866, been something of a study with him. He will seek to prove that a study of the river records should excite no alarm for the future.

AT PITTSBURGH.

It will be observed from the records that the flood of 1884 was only four inches higher than that of 1832, fifty-two years previous. Between the years 1851 and 1867, inclusive (omitting two years of which records are not known to exist), there were eight floods reaching twenty-five feet or over, five of which were over the 30-foot mark. The mean high water for the sixteen years was 24.7 feet.

During the second period, viz., from 1868 to 1884, inclusive, there were but four floods reaching as high as twenty-five feet, and not until the recent great flood did the river rise to thirty feet or over. The high-water mean for the period is 23.6 feet.

The low-water mean appears from the records from 1855 to date, when divided into two equal periods, to have been the same for both, viz., eight inches. The lowest water in the Ohio river at Pittsburgh, known to have been gauged, was in 1838, when Captain John Saunders, U. S. A., in charge of works of improvement, stated it to have been 85,000 cubic feet per minute. Captain F. A. Mahan, U. S. engineer in charge of the Davis Island dam, has on various occasions gauged the low-water discharge of the Ohio in periods of drought within the past few years. The lowest he reports was during the year 1879, viz., 96,000 cubic feet per minute, but Mr. Wm. Martin, Captain Mahan's assistant, reports that in 1881 the water was evidently lower, though it was not determined that year what the least discharge was.

There seems to me to be nothing in the river records of Pittsburgh on which to establish any theory either of increase in the height of floods or for less low-water discharge due to the destruction of forests *or to any other cause.*

The Ohio at Pittsburgh receives the drainage of about 13,000 square miles from its Allegheny river branch, with about 7,000 square miles tributary from the Monongahela, the two united making about 20,000 square miles. The Monongahela has been, since 1844, improved to the Virginia State line by a system of locks and dams. The records of the Navigation Company during this period do not indicate a tendency towards a decline, year by year, of the low-water discharge, notwithstanding the fact that probably more than half of its area has been stripped of timber.

I know from reliable information that quite a number of its tributaries in Washington, Fayette, and Greene counties, highly productive agricultural regions, now, as a general rule, fail or become dry earlier in the season than formerly, and that saw-mills located upon them have been abandoned from this cause or converted to the use of steam. The highest flood on this branch of the Ohio was in 1852, and during the long interval of thirty-three years no flood has risen to within four feet of that one.

The characteristics of some of the tributaries both of this and the Allegheny rivers are somewhat anomalous and worth particularizing. Thus the West Fork of the Monongahela river, in West Virginia, draining approximately seven hundred square miles, is still heavily timbered, yet this branch becomes in season of drought a little brook that one could at places in its ripples easily step over. Its entire loss at such a period would be inappreciable in the main stream; whereas the Cheat and Youghiogheny branches are always powerful streams, yet they originate and traverse open glades for miles where no trees have ever grown. The explanation of the apparent anomaly is quite simple when we come to understand it. The West Fork river has a remarkably slight fall, abounding in long shallow pools, which in the low lying country along its course is subjected to the excessive evaporation of an almost tropical sun. On the other hand the glades of the Cheat and Youghiogheny lie in highly elevated regions favored with cool mountain breezes.

The largest tributary of the Allegheny river, the Kiskiminetas, draining 1,300 square miles, also rises in the mountains, its sinuous course lying in the deepest seclusion,

amid the shade of forests, but being extraordinarily wide at many places, its low-water discharge dwindles to less than 35,000 gallons per minute; whereas French creek, not much in excess of 1,000 square miles drainage area, at the lowest stage I have known, discharges about 250,000 gallons per minute, or fully one-half of the Allegheny river. These gaugings were made by myself in 1879, French creek originates in an elevated plateau nearly 2,000 feet above the tide water. The country about its sources was always open, and was called by early French explorers the Beef Plains (from buffalo having been found there). It has a climate greatly modified and cooled by the winds from Lake Erie. If it be urged that its discharge might be even greater with a forest, what can we say for the Kiskiminetas and the West Fork, which still possess most of their original forests and which dry up practically?

I cite these instances not to dispute or prove any theory, but merely to emphasize the importance of considering the topography, and particularly the elevation and mean temperature, of regions before empirically asserting that the equable discharge of streams originating therein may be seriously deranged by human agencies.

THE OHIO AT CINCINNATI.

The river record of Cincinnati extends only from 1858 to 1884, inclusive. During the first period, viz., from 1858 to 1870, inclusive, five floods exceeded fifty-five feet in height, the highest being in 1862, when the water reached to fifty-seven feet four inches. Mean of the period, forty-nine feet eleven inches.

During the second period, viz., 1871 to 1883, inclusive, only three floods exceeded fifty-five feet (or four with the late flood included).

The mean of high waters was forty-nine feet and nine-tenths, or, including the late flood, the mean would be fifty-one feet three inches, as compared with forty-nine feet eleven inches of the first period. Two such phenomenally high floods occurring in two successive years seriously affects the average for a period as short as seventeen years. They stand alone, however, and unless wonderful works by the hand of man in two years can be shown to have changed the face of nature in the Ohio valley I can see no propriety in introducing them as factors in this discussion. We cannot, it is true, ignore the record they make, but in the light of the thirty-five years' record preceding, I cannot see that any one would have been safe in predicting their appearance.

The mean annual and low-water depths indicate a slight decline in the last period, as compared with the first, in this respect supporting the theory of Mr. Wex; but in the low-water record the difference, two inches, is so slight that it might be offset by even one year's time of water slightly better than the average. I am not aware of the fact, if it be true, that any guagings of the actual low-water discharge of the Ohio have been made at Cincinnati.

RAINFALL AND CLIMATIC CHANGES.

What I have heretofore said and argued I believe has the solid foundation of actual records for its support, and until the accuracy of the figures is called in question, I believe I can add no more to strengthen my statements regarding floods on our great interior rivers. Freshets superinduced by the destruction of forests on small water-courses may work great injury in certain neighborhoods, and the American Forestry Congress should in its wisdom devise means, to be enforced by the law-making powers of Canada and the United States, to remedy the evil complained of.

There remains a review of some of the curious statements and arguments put forth that the rain-fall is decreasing and that our climate is changing on account of the destruction of forests, which, if granted, would show at once on our river guages.

I can, of course, grant nothing of the sort regarding at least the country east of the Mississippi, but there are important reasons for believing that human agency is possibly affecting the climate west of the 100th meridian.

Up to about 1874 all west of the 100th meridian to the Rocky Mountains, excepting narrow strips along large tributaries of the Missouri and Mississippi, were generally regarded as veritable desert lands, entirely too arid for settlement. It was about this time that settlements had advanced to, but not encroached much beyond, the magical meridional line. Beyond were to be seen the blanched bones of the California overland emigrants, with those of their horses and cattle, as they had died from hunger, thirst, and exhaustion, with here and there the graves of the brave soldiers of Donephan, Albert Sidney Johnson, and other leaders of military expeditions against Mexicans, Indians, or Mormons. Truly our geographies until recent times were entitled to designate it as the Great American Desert. Nevertheless we have lived to see this so-called desert made to smile with verdure.

In an address delivered before the Third National Agricultural Convention in 1883 Professor Wilbur stated as follows:

"I have on many occasions taken the contrary position, viz., that we have no deserts in the United States except by our permission; that the march of moisture westward from the Missouri year by year indicates that the time is not far distant when there will be no need of any irrigating ditches in Colorado. I have watched this progress of moisture and have observed its increase from the Missouri river for 150 miles west."

Clarence King, United States geologist, in a paper states:

"The cycle of moisture which has recorded itself in the increased volume of Salt Lake is also evident in many other localities and in different ways. Mono and Owen's lakes, at the east base of the Sierras, show a corresponding rise, etc. From these facts it would appear that the existing climatic oscillation began before the year 1870 and was the first of the kind for over 270 years, because the deposition of snows in the mountains is greater than since the earliest growth of the present forests. The year 1866 is about the date of the increase of Salt Lake. Mono lake shows a rise in 1864 and the destructive avalanches began about 1860."

I visited Salt Lake in 1871 and again in 1872, and observed myself that fenced-up fields, formerly plowed, had been submerged, and it has since occurred to me that there was a connection between agricultural operations and an increase of moisture from the deposit of dew, but scarcely from rain-fall. I have been an attentive observer of the progress of settlement in the far West, and I believe from the statements of friends in Montana, where I have seen irrigation practiced, that farming can in some places be conducted now without such adventitious aid where formerly it was necessary; but, for the main part, I am convinced that the eastern side of the Great Desert always was tillable. General Custer seems to have thought so in 1874.

It simply was not tried. Expeditions usually crossed the region late in the season, whereas farmers plow up the land with the first opening of spring, and the rapidly-growing grain soon shades the ground and retards the evaporation of moisture.*

Farmers in Montana, even in 1871–2, sometimes only flooded their lands once to get the crops started, averring that that was all that was necessary to secure its maturing. I do not desire to discuss this branch of the question very far, rather preferring to wait for Signal Office reports a few years hence to verify the statement of Prof. Wilbur that natural moisture or rain-fall is increasing in the West.

Many friends of forestry regulations assert quite positively, however, that the destruction of timber decreases the rain-fall. I have spoken of the far West to show there are possible compensations for this decrease in agricultural operations, which usually follow the destruction of the timber. But here again I would call upon these gentlemen for the authority for their oft-repeated assertions that the destruction of forests decreases or has one particle of effect upon the rain-fall. My figuring, so far, leads to quite the contrary conclusions. Official rain-gauge records for many stations throughout the country are not obtainable previous to 1871. To assist in arriving at the facts, I have selected thirty-seven of these stations for the decade between 1870 and 1880, and taking them by halves, the second half exhibits an increase of 1.68 inches of rainfall per annum over the first half. In making the selections of stations, I purposely took a greater percentage from the regions where lumbering operations are carried on most extensively. Every one of the Michigan and Wisconsin stations reports more rain-fall in the last than in the first half of the decade.

By combining the rain-gauge records of Pittsburgh and Cannonsburg, a town in the vicinity of Pittsburgh, (Pittsburgh records not being obtainable before 1871), I have prepared a table exhibiting the rain-fall for thirty-nine years, viz: from 1845 to 1884. Divided into two nearly equal periods, the second shows an average increase over the first of 2.67 inches rain-fall per annum. Taking the record of the city of Philadelphia, from 1810 to 1875, the average rain-fall by decades is as follows:

1810 to 1820	32.79 inches.
1820 " 1830	36.63 "
1830 " 1840	42.65 "
1840 " 1850	44.57 "
1850 " 1860	44.09 "
1860 " 1870	49.37 "
1870 " 1875	48.35 "

*As the forests, if planted, would do to a much greater extent and persistently.—F.

The above figures appear to indicate, with the settlement of the country, that the rain-fall is increasing. These tables are by no means exhaustive, and it might not be safe to venture an opinion based upon them.

The anonymous writer, whom I previously quoted from the columns of "Forest and Stream," produces what he calls figures, but which I think he desires us to consider figures of speech, on this very point They are curious and interesting at all events, and I quote them:

"A few figures will render the influence of forests in the maintenance of rain-fall over the great central region of this continent strikingly apparent.

"Supposing the rain-fall of this region dependent directly on ocean currents, amounts to a general average of twenty inches; if there were no forests nor other vegetation creating a retentive soil, the rivers would annually discharge a volume of water equal to the rain-fall; but if it were dotted with forests, the floor of which retained only one inch of the twenty, the river discharge would be reduced to nineteen inches, a saving which, if it could be maintained, would be equal to more than eight feet of water over the whole region in a century. Of the water thus retained by vegetation, a portion is employed in keeping the soil constantly, moist and another portion is constantly suspended in the atmosphere, falling as rain or dew, and being continuously re-evaporated and reprecipitated. Forests may thus raise the rain-fall to double or three times the amount due to ocean currents, and, following their destruction, the whole surplus is borne into the rivers, which overflow their banks in their efforts to discharge it into the sea. Every great flood reduces the interior reservoir, thus inducing a gradually-diminishing rain-fall, with a gradual diminution in the violence of the floods, until finally the region is dependent on ocean currents only for its moisture; and it may be safely argued that when the great region lying between the Appalachian and Rocky Mountain chain shall have its rain-fall limited to the supply inborne by ocean currents it will cease to be an agricultural country."

I do not understand how moist air can be suspended over woodlands to be continuously precipitated and re-evaporated. I believe that every drop of moisture eastward, across the northern part of the continent to the Allegheny range, comes from the Pacific ocean. The average annual wind-mileage at Pittsburgh is 55,000 miles, very little of which comes from the east. East winds west of the mountains are simply the undertow, or air set in motion backwards for a short time, as an eddy under a rapidly-advancing, powerful, and high westerly or northwesterly wind.

"The east wind brings the storm," but the great rain clouds unceasingly float eastwardly. Lewis and Clarke, as early as 1803, observed, when on the Missouri river, that every cloud passed over them from the west, being undoubtedly the first recorders of the great natural phenomena. Such being the case our anonymous friend's moisture must be borne with it at the average rate of fully 125 miles per day, giving it not much time to coquet with the tree-tops in a given locality. Just how all this rain crosses the almost rainless interior, through a generally cloudless sky, is an interesting speculation. Undoubtedly it travels faster over the plains and accumulates over us more frequently to the point of saturation.

The editor of "Forest and Stream" indulges in the following, which the writer, with due respect, considers an incautious argument in a good cause:

"The forests of the National Park protect the heads of two of the most important rivers of North America, one, the Snake, flowing into the Pacific, and the other, the Yellowstone, finding its way into the Atlantic. These streams, after leaving the mountains, flow for long distances through arid regions which are only cultivable by means of irrigation, and should the forests about the head of these rivers be cleared away their volume would be so dimished that the farmers, who now and in the future will depend on them for their water-supply, whould be absolutely unable to raise crops."

The writer traveled several thousand miles during two years through the Rocky Mountain region in various directions, including a portion of the country adjacent to the National Park, and in all the distance traversed never saw a living stream after July first dependent in any degree upon rain-water for its supply. After that date their unfailing source of supply, where they exist at all, is snow, which usually lies and melts in gulches above the tree-line. Powell's and other peaks in Montana, Mts. Hood and Ranier have everlasting snows upon them above arborescent growth. Many of the mountain streams, like the Judith and the Muscleshell in Eastern Montana, actually disappear by loss from evaporation in the lower parts of their course, while strong streams difficult to ford are higher up. The Missouri, I believe, after September first until the first snow, discharges more water at Fort Benton than it does 500 miles below at its junction with the Yellowstone, its tributaries not nearly supplying the loss due to evaporation. The entire Missouri, according to Humphrey and Abbot, draining 514,000 square miles, discharges into the Mississippi only 3.7 trillion cubic

feet per annum as compared with five trillion cubic feet for the Ohio, which has only 200,000 square miles in its basin.

The diversities in the characteristics of the two streams are very great. The Missouri will in the near future afford the friends of tree-culture a field for experiment on the grandest scale to test the effect of settlement and agricultural operations over an immense treeless plain upon its natural regimen, and I would look for more pronounced results in the Missouri than appears to have rewarded the labors of observers in eastern streams in support of their favorite theory.

As it may be interesting to note the grounds on which Mr. Wex and others base their theories that the destruction of forests affects the high and low water stages of rivers, I will here introduce some paragraphs from various authorities:

Berghaus mentions in his Hydrography, heretofore cited by me, that the decrease in the discharge of the Elbe since 1782 is caused by the decrease of the rain-fall which has taken place in its basin since that time. The cause of this is stated, both by Berghaus and Malte Brun, to be in the clearing of forests, since the attraction of the latter draws electricity and water from the clouds and increases the amount of the rain-fall.

It is a common source of wonder with Germans in this country that our forests are not protected and renewed as they are in Germany; but if we can believe Berghaus and Malte Brun, the German laws on this subject cannot be universally applied throughout the empire.

"It is a fixed fact which has been proven by numerous observations that the clearing of forests dries up springs, and that when they again grow the latter flow more abundantly and regularly. * * * Boussingault says: "It is my opinion that the clearing of forests over a large area has always the effect of diminishing the annual rain-fall." The learned Coultas makes the following comparison: "The ocean winds and forests may be considered as the different parts of a great distillery. The sea is the boiler in which the steam is created by heat of the sun. The winds are the pipes which lead the steam to the forests where a lower temperature exists. For this reason the steam is condensed, and in this manner forests distill showers of rain," &c.

Observations with a rain-guage before and after the clearing of a particular forest region would have been an admirable indorsement of Boussingault's views.

Mildrum, the director of the observatory on Mauritius Island, has found that since 1852, when at least 44,155 acres had been cleared, the rain-fall, humidity, and pressure of vapor had decreased, and, on the contrary, the floods and dry periods have increased.

The clearing of less than seventy square miles producing such decided effects is remarkable. Seventy square miles represent about the one-ninth of the island, but such areas have frequently been cleared in the United States without in the least decreasing the rain-fall.

The report of Mr. Matthieu, professor of the Imperial School of Forestry, was published by the French Government, in which he shows that it is proven by experiment that the amount of aqueous vapor over a cleared field is five times as great as over ground covered with forests, which he considers equivalent to an increase in the annual rain-fall in sections of countries covered with forests. Professor H. W. Dove, one of the first authorities in the knowledge of weather, says: "Europe has worked itself into continually irregular rainy seasons by the modern cultivation of its lands, which crowds off the forests recklessly, and which causes its rivers to be nearly dry during long periods, while during others their banks can hardly retain the masses of the water which are poured into them."

Then Mr. Wex, in his summary, says:

"The existence of forests in a country increases the amount of rain-fall, because the fogs and clouds, saturated with aqueous vapor which sweep over it, are, in the first place, condensed by contact with them and fall in the shape of rain."

This short, simple assertion could have been verified in one year's time by observations on neighboring rain gauges—one in a forest and the other stationed in an open plain—but Mr. Wex quotes no one who has tried this experiment. He continues to say:

"Forests increase the amount of subterranean seepage and water in springs considerably, since the rains, being retained by the leaves of the trees, fall to the earth slowly. They are then retarded in their flow by the spongy surface, and are partly soaked in and partly sink into the deeper layers of the earth," &c.

Professor G. K. Gilbert, in Powell's Land of the Arid Regions, in a report on the water supply of the Great Salt Lake of Utah, says:

"The cutting of trees for timber and fence material and fuel has further increased the streams. By the removal of foliage that share of the rain and snow which was formerly caught by it and thence evaporated is now permitted to reach the ground, and some part of it is contributed to the streams."

Thus authorities will philosophize differently.

Again Mr. Wex says:

"A further cause of the decrease in the discharge of springs and streams of many countries in Europe during the last decades, is the emptying of lakes and ponds and the drainage of swamps and marshes."

We will let Professor Gilbert answer this. He says, quoting from the report just mentioned:

"Small springs are apt to produce bogs, from which much water is evaporated," &c.

It appears arguments can be produced from nature to support any theory. She rains not only on the just and the unjust alike, but quite possibly denies the ploughed field, which needs it most, no favors which she would give the woodlands.

Lastly, Mr. Wex says that in cultivated and thickly-settled regions much water from our rivers is withdrawn for the purposes of irrigation; he might have added for manufactures also. It is believed that scarcely a half of the water used by great cities returns to the streams from which it was originally drawn. Undoubtedly such considerations as these would have great weight in some regions, dependent upon the proportion withdrawn for these purposes as compared with the original stream. There is little irrigation practiced in the Ohio basin, and the quantity of water pumped out to supply the cities lining its banks is probably too insignificant a proportion of the whole low-water discharge to require notice.

The *Sanitary Engineer*, in a recent article, says: "The surface of the ground, when shaded by forest trees, is always covered with a spongy layer of old leaves or mosses favoring the absorption of water, while the fallen logs and underbrush obstruct the flow on the surface."

We have never had but one destructive summer or fall flood on the Ohio, and that was in November, 1810, when the Ohio basin was a virgin forest. All other high floods have occurred in the early spring, at periods when the "spongy" layers of leaves and moss must have been soaked to saturation by earlier rains and snows. It may be that changed conditions of the surface, such as the destruction of forests and cultivating and draining the soil, may have a sensible influence in increasing the height of summer freshets, which might be termed floods of intermediate height; but in February, when the great floods usually occur, the previously-saturated soil and overflowing marshes are merely like other surfaces, the same everywhere, and, therefore, can have no regulating effect on floods.

Mr. W. Milnor Roberts, in a report on the surveys of the Ohio river, referring to some views previously expressed by him in a pamphlet printed by the Franklin Institute, and combating the theories of Chas. Ellet in favor of reservoirs as a means to hold back floods on the Ohio, says: "It was proved from an examination of the records of the floods on the upper part of the Ohio, that some of the highest floods occurred when such reservoirs, had they been in existence, must have been full. Such being the case, they could not have aided in restraining those floods, and this would certainly be the case almost every year."

If Mr. Roberts could argue this way, in view of the fact that Mr. Ellet's dams across the heads of the Ohio would be, in some instances, 100 feet high, reaching from hill to hill and of enormous storage capacity, he certainly would have placed little reliance on moss, leaves, marshes, and forests as restraining reservoirs for spring freshets in the Ohio valley.

More has been done by the hand of man on the North American continent in the removal of forests during the last forty years than has probably been accomplished in Europe in a century and a half. Moreover, the proportion of mountain land in Europe is considerably greater than it is in the eastern United States. If, therefore, decrease of rain-fall, or other meteorological phenomena, are affected by such means, they would be most marked in the regions of plains, and particularly in rapidly-cleared and settled plains. In the Allegheny valley above Pittsburgh several billion feet of lumber have been cut in the last forty years, and a vastly larger quantity of timber has been recklessly destroyed by forest fires and by the process of girdling trees in opening up farms.

Preceding the great flood of 1884 in the Ohio valley its entire northeast section, embracing an area of fully 70,000 square miles, was visited with an unprecedented snow-fall, covering the country to the depth of from fourteen inches to over two feet. Following upon this came a season of over a week's continuous warm rain, which melted the snow rapidly. Even before the great snow storm the ground had been covered with snow and the rivers were moderately full before the flood commenced. Observation has shown that a river will discharge vastly more water per minute at a given high stage, if the rise to the assumed mark has been sudden, than it will at the same stage when the rise has been slow. With low water below on a stream and high water above the river's slope is increased; hence follows increase of velocity and greater discharging capacity. The great flood on the Ohio was comparatively sluggish, for, as before said, its prism was comparatively full before the flood commenced, and its slope or inclination of surface when at the maximum of its height was less than the average inclination of the river. The flood of 1883, when the Ohio was at a twenty-seven-foot stage at Pittsburgh, flowed for a while with a current of nearly eleven miles an hour, whereas the flood of 1884, when at a stage of over thirty feet, flowed at the rate of only a little more than eight miles an hour; so that I apprehend there were hours when the twenty-seven-foot flood discharged as much water as the great flood did at its maximum. It is, therefore, important to understand the precedents of a great flood in order to determine the probable effect of a given amount of rain or snow fall.

The popular opinion no doubt will long be that the destruction of forests increases the height of floods, but I am persuaded it is not a belief founded on established fact.

Table Showing Highest, Lowest, and Mean of Water at Pittsburgh, and Averages for Two Periods.

Date.	Year.	Highest.	Mean.	Lowest.	Remarks.
November 10	1810	32.			
January	1813	29.			
February	1816	33.			
February 10	1832	34.			
February 1	1840	26.9			*High Water.*
February 1	1847	26.			
September 20	1851	30.9			First period, 1847 to 1863. Average for the period is 24 feet 7 inches.
April 19	1852	31.9			
	1853	31.9			
	1855	18.0		2.10	
	1856	19.6		0.3	
	1857	21.4		0.0	
	1858	26.0		0.5	*Low Water.*
	1859	22.0		1.1	
April 12	1860	29.7		2.8	First period, 1855 to 1870. Average for the period is 8 inches.
September 29	1861	30.9½		1.10	
January 20	1862	28.7		0.3	
January 16	1863	16.0		0.1	
December 17	1864	18.6		1.0	
March 8	1865	31.4		1.4	
February 25	1866	15.4		0.4	*High Water.*
March 13	1867	22.6		0.0	
April 15	1868	20.6	5.1	0.0	Second period, 1868 to 1884. Average for the period is 23 feet 6 inches.
March 31	1869	19.6	6.2	0.7	
January 19	1870	18.0		1.3	
January 15	1871	19.0		1.2	
April 11	1872	20.6		1.6	
December 14	1873	25.6		1.6	
January 8	1874	22.4		1.1	*Low Water.*
August 3	1875	25.0	6.15	0.4	
September 19	1876	26.0	5.88	0.2	Second period, 1870 to 1884. Average for the period is 8 inches.
January 17	1877	25.0	4.95	0.7	
December 11	1878	24.6	5.20	0.0	
March 19	1879	20.0	4.30	0.1	
February 14	1880	22.0	4.70	0.3	
January 10	1881	28.0	4.96	0.6	
January 28	1882	21.9	5.11.6	0.6	
February 8	1883	27.6	5.11.3	0.1	
February 6	1884	34.4⅛			

Statement Showing the Highest, Lowest, and Average Stages of the Ohio River at Cincinnati each Calendar Year, from 1858 *to* 1883, *including Floods of* 1832 *and* 1847.

CALENDAR YEAR.	HIGHEST STAGE.		LOWEST STAGE.		AVERAGE.
	Date.	Ft. In.	Date.	Ft. In.	Ft. In.
1832	February 18	64.3			
1847	December 17	63.7			
1858	June 16	43.10	October 3	2.5	12.10
1859	February 22	55.5	September 19	3.3	17.7
1860	April 16	49.2	October 3	5.4	16.
1861	April 19	49.5	July 3	5.1	19.1
1862	January 24	57.4	October 31	2.4	17.5
1863	March 12	42.9	October 6	2.6	15.
1864	December 23	45.1	August 6	3.1	16.8
1865	March 7	56.3	October 19	5.8	21.10
1866	September 26	42.6	August 17	4.9	19.2
1867	March 14	55.8	October 19	3.0	17.
1868	March 30	48.3	July 21	5.1	18.8
1869	April 2	48.9	August 21	5.4	19.8
1870	January 19	55.3	October 4	3.10	17.10
1871	May 13	40.6	October 14	2.8	11.10
1872	April 13	41.9	October 14	3.	11.8
1873	December 18	44.5	October 12	3.8	18.5
1874	January 11	47.11	September 29	2.4	15.8
1875	August 6	55.4	September 19	4.3	18.9
1876	January 29	51.9	September 4	6.2	18.2
1877	January 20	53.9	October 9	3.3	15.
1878	December 15	41 4	October 24	4.4	16.9
1879	December 27	42.9	October 23	2.6	14.6
1880	February 17	53.2	October 28	3.9	17.
1881	February 16	50.7	September 18	1.11	16.11
1882	February 21	58.7	November 1	6.1	22.1½
1883	February 15	66.4	September 21	3.7	19.5½

Table Showing Wave of the Flood of 1884 *at Different Stations Along the Allegheny and Ohio Rivers. Records Taken on the Same Dates.*

	January 30.	January 31.	February 1.	February 2.	February 3.	February 4.	February 5.	February 6.	February 7.	February 8.	February 9.	February 10.	February 11.	February 12.	February 13.	February 14.
Oil City	2.4	5.0	5.6	5.4	.....	6.0	13.0	13.3	12.0	10.2	9.0	.....	8.	8 8	8.8	13.1
Freeport	5 8	8.0	12.2	11.6	11.6	9.3	14.2	30.0	28.6	22.2	.....	18.6	16.10	15.8	15.10	19.8
Pittsburgh	3.4	8.5	20.5	17.4	12.10	11.1	15.10	34.4¼	31.8	26.3	21.3	18.5	16.11	18.4	18 0	17.10
Wheeling	8.10	.....	20.0	.....	.....	22.0	.....	.....	.....	.....	.....	.....	30.	.....	29.6	29.0
Marietta	.....	21.6	21.6	25.6	28.4	25.3	29.0	37.8	46.3	49.6	52.0	48.3	46.1	38.0	35.0	34.0
Point Pleasant	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portsmouth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cincinnati	18.1	31.3	38.8	46.2	49.5	49.11	52.8	59.5	61.8	62.7	63.9	64.9	66.5	68.5	69.11	71.1
Louisville	8.0	11.0	13.7	16.10	21.8	24.0	27.8	34.1	38.5	39.8	40.3	40.4	41.1	42.4	44.0	45.7
Evansville	.....	15.5	18.1	23.6	29.	32.7	35.5	37.9	40.6	42.8	44.1	44.9	45.3	45.6	46.	46.3½
Cairo	24.11	25.8	25.8	26.6	29.5	32.5	34.7	37.10	40.10	42.8	44.	45.1	46.	46.10	47.7	48.4

	February 15.	February 16.	February 17.	February 18.	February 19.	February 20.	February 21.	February 22.	February 23.	February 24.	February 25.	February 26.	February 27.	February 28.	February 29.	
Oil City	12.6	10.0	9.0	8.5	6.6	6.0	6.8	5.7	5.7	5.7	5.7	5.5	4.11	4.8		
Freeport	17.4	15.0	12.6	13.0	11.9	11.4	12.4	11.6	9.10	8.10	7.11	7.8	7.3	7.0		
Pittsburgh	20.10	17.11	14.3	15.4	13.3	12.6	12.6	11.5	10.1	9.1	8.1	7.6	7.2	6.10		
Wheeling	31.9	28.7	25.5	22.3	19.0	20.6	19.0	19.3	17.5	15.7	13.8	12.0	11.4			
Marietta	33.6	31.6	29.0	27.0	24.2	23.0	21.0	20.0	19.0	18.0	15.6	14.1	13.2	11.10	9.6	
Point Pleasant	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Portsmouth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Cincinnati	70.1	68.4	66.0	63.5	60.3	58.10	55.5	52.0	48.5	45.2	40.10	36.10	32.11	29.8		
Louisville	46.6	46.6	45.8	44.5	42.6	41.3	39.1	36.1	32.11	29.3	24.8	21.8	17.6			
Evansville	46.10	47.3	47.6½	47.10¾	48.	48.¼	47.11¾	47.8	47.3¼	46.9	46.	45.3	44.	42.6	41.1	
Cairo	49.1	49.10	50.5	50.10	51.3	51.7	51.9	51.10	51.10	51.10	51.8	51.6	51.2	50.		

Rain-Gauge Records—Canonsburgh and Pittsburgh.

Year.	Inches.	Remarks.
1845	27.54	
1846	40.81	
1847	39.61	Canonsburgh is 20 miles south-west from Pittsburgh. The Pittsburgh record begins with 1871.
1848	31.59	
1849	32.72	
1850	31.00	
1851	23.74	
1852	39.48	There are no records for either place in 1870.
1853	25.48	
1854	20.86	
1855	41.91	
1856	25.07	
1857	43.53	
1858	31.59	Average rainfall from 1845 to 1863, inclusive, 35.01 inches.
1859	39.23	
1860	39.43	
1861	36.46	
1862	31.61	
1863	33.58	
1864	39.95	Average rainfall, 1864 to 1883, inclusive, 37.68 inches.
1865	43.90	
1866	36.51	
1867	29.77	
1868	30.61	
1869	36.60	
1870		Increase of the second period over the first period is 2.67 inches.
1871	24.35	
1872	30.78	
1873	41.57	
1874	39.34	
1875	34.06	
1876	37.01	
1877	34.72	
1878	38.76	
1879	37.02	
1880	31.97	
1881	37.30	
1882	38.61	
1883	43.17	
1884		

Table of Rain-fall in Philadelphia from 1810 *to* 1875.

(Report of the Commission of Engineers on the Water Supply of Philadelphia.)

Year.	Rainfall.	Average.	Year.	Rainfall.	Average.	Year.	Rainfall.	Average.	Remarks.
	Inches.	*Inches.*		*Inches.*	*Inches.*		*Inches.*	*Inches.*	
1810	32.66		1840	47.40		1870	44.11		
1811	34.97		1841	55.50		1871	47.32		
1812	39.30		1842	48.54	Fourth Period.	1872	51.12	Seventh Period.	
1813	35.63		1843	46.91		1873	58.29		
1814	43.14		1844	40.17		1874	40.91	48.35	
1815	34.67		1845	40.02					
1816	27.95	First Period.	1846	44.39					
1817	36.01		1847	45.09					
1818	30.18		1848	35.00					
1819	23.35	32.79	1849	42.09	44.57				
1820	39.61		1850	54.54					
1821	32.18		1851	35.50					
1822	29.86		1852	45.75	Fifth Period.				
1823	41.85		1853	40.66					
1824	38.74		1854	40.18					
1825	29.57		1855	44.09					
1826	36.15		1856	33.93					
1827	38.50	Second Period.	1857	48.29					
1828	37.97		1858	30.85					
1829	41.85	36.63	1859	58.12	44.09				
1830	45.07		1860	44.09					
1831	44.94		1861	46.44					
1832	39.87		1862	45.01	Sixth Period.				
1833	48.55		1863	49.19					
1834	34.24		1864	46.00					
1835	39.30		1865	56.26					
1836	42.66		1866	45.26					
1837	39.04	Third Period.	1867	61.19					
1838	45.24		1868	51.40					
1839	43.74	42.65	1869	48.86	49.37				

Average Rain-fall of Thirty-seven Points in the United States.

Divided into Two Periods—First, from 1871 to 1875, inclusive; Second, from 1876 to 1880, inclusive.

Place.	Average.		Increase.	Decrease.
	First Period.	Second Period.		
	Inches.	*Inches.*	*Inches.*	*Inches.*
Breckenridge, Minn.	25.20	25.59	.39	
Cairo, Ill.	44.47	46.36	1.89	
Chicago, Ill.	33.06	35.45	2.39	
Cincinnati, O.	39.06	47.03	7 97	
Cleveland, Ohio.	35.19	41.61	6.42	
Detroit, Mich.	28.95	40.77	11.82	
Duluth, Minn.	32.68	35.61	2.93	
Escanaba, Mich.	33.58	34.14	.56	
Grand Haven, Michigan.	35.64	37.47	1.83	
Indianapolis, Ind.	46.36	45.82		.54
Knoxville, Tenn.	56.81	48.96		7.85
La Crosse, Wis.	33.32	34.31	.99	
Marquette, Mich.	28.06	33.87	5.81	
Memphis, Tenn.	50.31	58.45	8.14	
Milwaukee, Wis.	30.72	37.93	7.21	
Morgantown, W. Va.	47.84	45.45		2.39
Nashville, Tenn.	50.90	54.00	3.10	
Pittsburgh, Pa.	38.48	35.89		2.50
St. Louis, Mo.	35.78	38.01	2.23	
St. Paul, Minn.	32.88	29.48		3.40
Toledo, O.	29.67	33.67	4.00	
Vicksburgh, Miss.	58.97	60.42	1.45	
Buffalo, N. Y.	34.03	40.74	6.71	
Dubuque, Ia.	38.85	37.49		1.36
Erie, Pa.	41.22	42.09	.87	
Fort Gibson, Ind. Ter.	39.48	36.78		2.70
Galveston, Texas.	52.12	51.32		.80
Indianola, Texas.	38.94	38.59		.35
Keokuk, Ia.	38.65	37.81		.84
Leavenworth, Kan.	35.96	42.02	6.06	
Lynchburg, Va.	42.35	40.88		1.47
Montgomery, Ala.	58.45	52.08		6.37
Omaha, Neb.	32 19	33.86	1.67	
Oswego, N. Y.	31.28	40.40	9.12	
Port Huron, Mich.	32.97	35.37	2.40	
Rochester, N. Y.	37.61	39.15	1.54	
Yankton, Dakota.	29.97	25.38		4.59
	1431.90	1494.15	97.50	35.25

Note.—The general average for the thirty-seven stations above mentioned is 1.68 of an increase in the second period over the first.